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MEDICINE
DENTISTRY
PHARMACY

1958-1960 GRADUATE COLLEGE CATALOG

MEDICINE
DENTISTRY
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MEDICINE

UNIVERSITY OF ILLINOIS CHICAGO PROFESSIONAL COLLEGES

DENTISTRY
PHARMACY

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GRADUATE COLLEGE CATALOG

CHICAGO
PROFESSIONAL
COLLEGES
DENTISTRY
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Term 1955-1961

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Harry Wisler Pearce, B.S., Superintendent of Buildings and Grounds for the Chicago Departments
Wilma Troxel, A.M., Librarian in the Quine Library of Medical Sciences
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Buford Hall, B.S., M.D., Director of Health Service for the Chicago Departments
George McGregor, A.M., Associate Director of Nonacademic Personnel

CALENDAR 1957-1958

1957 — FALL QUARTER

Registration	Sept. 23, Mon.-Sept. 25, Wed.
Latest date to apply for French and German examinations	Sept. 27, Fri.
Latest date to pay fees without penalty	Sept. 27, Fri.
Instruction begins	Sept. 30, Mon.
Thanksgiving Day (classes dismissed)	Nov. 28, Thurs.
Examination period	Dec. 16, Mon.-Dec. 21, Sat.
Quarter ends	Dec. 21, Sat.

1958 — WINTER QUARTER

Registration	Dec. 16, Mon.-Dec. 17, Tues.
Latest date to apply for French and German examinations	Jan. 3, Fri.
Latest date to pay fees without penalty	Jan. 3, Fri.
Instruction begins	Jan. 6, Mon.
Latest date to file applications for University fellowships	March 14, Fri.
Examination period	March 24, Mon.-March 29, Sat.
Quarter ends	March 29, Sat.

1958 — SPRING QUARTER

Registration	March 24, Mon.-March 25, Tues.
Latest date to apply for a degree in June	April 4, Fri.
Latest date to apply for French and German examinations	April 4, Fri.
Latest date to pay fees without penalty	April 4, Fri.
Instruction begins	April 7, Mon.
Latest date for candidates for degrees in June to file completed thesis	May 23, Fri.
Memorial Day (classes dismissed)	May 30, Fri.
Latest date for oral examinations for M.S. and Ph.D. degrees	June 2, Mon.
Examination period	June 16, Mon.-June 21, Sat.
Commencement	June 20, Fri.
Quarter ends	June 21, Sat.

1958 — SUMMER QUARTER

Registration	June 23, Mon.-June 24, Tues.
Latest date to pay fees without penalty	June 27, Fri.
Instruction begins	June 30, Mon.
Independence Day (classes dismissed)	July 4, Fri.
Labor Day (classes dismissed)	Sept. 1, Mon.
Examination period	Sept. 15, Mon.-Sept. 20, Sat.
Quarter ends	Sept. 20, Sat.

THE TEACHING FACULTY FOR GRADUATE WORK AT THE CHICAGO PROFESSIONAL COLLEGES

Abood, Leo George, Ph.D., Associate Professor of Neurophysiology and of Biological Chemistry

Abramson, David Irvin, M.D., Professor of Physical Medicine and Rehabilitation, Head of the Department, and Professor of Medicine

Alpert, Norman Roland, Ph.D., Assistant Professor of Physiology

Armstrong, Sinclair Howard, Jr., A.B., M.D., Professor of Medicine

Bailey, Percival, Ph.D., M.D., Distinguished Professor of Neurology and Neurological Surgery and Clinical Professor of Psychiatry

Batson, Herbert Clifford, Ph.D., Professor of Biostatistics (Department of Public Health)

Bauer, Ludwig, Ph.D., Assistant Professor of Chemistry

Bennett, Granville Allison, B.S., M.D., Professor of Pathology and Dean of the College of Medicine

Bhaskar, Surindar Nach, D.D.S., Ph.D., Assistant Professor of Oral Pathology (on leave of absence)

Binkley, Stephen Bennett, Ph.D., Professor of Biological Chemistry

Birch, Carroll LaFleur, M.S., M.D., Professor of Medicine

Bliss, Harry Amesman, A.B., M.D., Assistant Professor of Medicine

Blomquist, Conrad Alvin, Ph.D., Assistant Professor of Zoology

Bonin, Gerhardt von, M.D., Professor of Anatomy

Brodie, Allan Gibson, D.D.S., Ph.D., Professor of Orthodontics and Head of the Department

Busch, Harris, M.D., Ph.D., Associate Professor of Pharmacology

Camp, Walter John Richard, M.D., Ph.D., Professor of Pharmacology and Toxicology

Carmichael, Hugh Thompson, M.D., C.M., M.S., Clinical Professor of Psychiatry

Catchpole, Hubert Ralph, Ph.D., Research Associate Professor of Pathology

Clarke, Charles Wildman, M.S., Associate Professor of Chemistry

Cole, Warren Henry, B.S., M.D., Professor of Surgery and Head of the Department

Crandall, Lathan Augustus, Jr., M.D., Ph.D., Lecturer in Physiology

Crane, Frank A., Ph.D., Assistant Professor of Pharmacognosy

Daniels, Ralph, Ph.D., Assistant Professor of Chemistry

Davis, Carl Braden, Jr., A.B., M.D., Clinical Associate Professor of Surgery

Deardorff, Dwight Luverne, Ph.D., Professor of Manufacturing Pharmacy

De Takats, Géza, M.S., M.D., Clinical Professor of Surgery

Dowling, Harry Filmore, A.B., M.D., Professor of Medicine and Head of the Department

Engel, Milton Baer, M.S., D.D.S., Professor of Orthodontics

Foley, Edmund Francis, B.S., M.D., Professor of Medicine

Forster, George Francis, Ph.D., Lecturer in Microbiology, with rank of Assistant Professor

Fuller, John Burt, B.S., M.D., Associate Professor of Pathology

Gearien, James Edward, Ph.D., Associate Professor of Chemistry

Gerty, Francis Joseph, M.D., Professor of Psychiatry and Head of the Department
Gibbs, Frederic Andrews, M.D., Professor of Electroencephalography
Gillette, Roy J., Ph.D., Assistant Professor of Histology
Glaviano, Vincent V., Ph.D., Assistant Professor of Physiology
Greenberg, Ruven, Ph.D., Associate Professor of Physiology
Guillemin, Victor, Jr., Ph.D., Professor of Biophysics (Department of Physiology)
Harvey, Roger Allen, M.S., M.D., Professor of Radiology and Head of the Department
Hass, George Marvin, M.D., Professor of Pathology
Hick, Ford Kimmel, M.D., Ph.D., Professor of Medicine
Himwich, Harold Edwin, M.D., Lecturer in Physiology
Hoffman, William Samuel, Ph.D., M.D., Lecturer in Medicine
Horwitt, Max Kenneth, Ph.D., Associate Professor of Biological Chemistry
Hughes, William Franklin, A.B., M.D., Professor of Ophthalmology and Head of the Department
Ingraham, Raymond Clifford, Ph.D., Professor of Physiology
Ivy, Andrew Conway, M.D., Ph.D., D.Sc., LL.D., Distinguished Professor of Physiology and Head of the Department of Clinical Science
Jackson, George Gee, A.B., M.D., Associate Professor of Medicine
Johnson, Clarence Albert, Ph.D., Assistant Professor of Biological Chemistry
Joseph, Norman Ross, Ph.D., Associate Professor of Chemistry
Julian, Ormand C., M.D., Ph.D., Associate Professor of Surgery
Kark, Robert Manoah, A.B., D.C.H., Professor of Medicine
Kempf, John Emerson, A.B., M.D., Professor of Microbiology
Kesel, Robert George, M.S., D.D.S., Professor of Applied Materia Medica and Therapeutics and Head of the Department
Kirch, Ernst Rudolf, Ph.D., Professor of Chemistry
Kohn, Paul, Ph.D., Assistant Professor of Biological Chemistry
Krakower, Cecil Alexander, B.S., M.D., C.M., Professor of Pathology and Head of the Department
Krehbiel, Robert Henry, Ph.D., Associate Professor of Anatomy
Laskin, Daniel M., D.D.S., M.S., Associate Professor of Oral and Maxillofacial Surgery
LaVelle, Arthur, Ph.D., Assistant Professor of Anatomy
Le Beau, Leon Joseph, Ph.D., Assistant Professor of Microbiology
Lederer, Francis Loeffler, B.S., M.D., Professor of Otolaryngology and Head of the Department
Levinson, Samuel Azor, M.D., Ph.D., Professor of Pathology
Lichtenstein, Ben William, M.S., M.D., Clinical Professor of Neurology
Limarzi, Louis Robert, M.S., M.D., Associate Professor of Medicine
Macey, Robert Irwin, Ph.D., Research Associate in Physiology
MacFadyen, Douglas Archibald, A.M., M.D., Professor of Biological Chemistry
Mackay, Roland Parks, A.B., M.D., Clinical Professor of Neurology
Marbarger, John Porter, Ph.D., Professor of Physiology and Director of Research in the Aeromedical and Physical Environment Laboratory

Markowitz, Abraham S., Ph.D., Assistant Professor of Pathology and of Microbiology

Martin, William Robert, M.D., M.S., Assistant Professor of Pharmacology

Massler, Maury, D.D.S., M.S., Professor of Pedodontics and Head of the Department

McGrew, Elizabeth A., A.B., M.D., Associate Professor of Pathology

Meduna, Ladislas Joseph, M.D., Professor of Psychiatry

Mengert, William F., B.S., M.D., Professor of Obstetrics and Gynecology and Head of the Department

Meyer, Esther, Ph.D., Ph.G., Associate Professor of Microbiology

Monsen, Harry, Ph.D., Assistant Professor of Anatomy

Montgomery, Max Malcolm, M.S., M.D., Associate Professor of Medicine

Moos, Walter Samuel, Ph.D., Associate Professor of Radiology

Myers, Terrell C., Ph.D., Assistant Professor of Biological Chemistry

Nielson, Paul Ellis, Ph.D., M.D., Associate Professor of Psychiatry

Novak, Milan Vaclav, Ph.D., M.D., D.Sc., Professor of Microbiology, Head of the Department, and Associate Dean of the Graduate College

Oldberg, Eric, M.D., Ph.D., Professor of Neurology and Neurological Surgery and Head of the Department

Perkins, Alfred James, Ph.D., Associate Professor of Chemistry

Pilot, Isadore, B.S., M.D., Clinical Associate Professor of Medicine

Pirani, Conrad Levi, M.D., Professor of Pathology

Plagge, James Clarence, Ph.D., Associate Professor of Anatomy

Pollock, George H., M.D., Ph.D., Clinical Associate Professor of Psychiatry

Puestow, Charles Bernard, M.D., Ph.D., Clinical Professor of Surgery

Rafelson, Max Emanuel, Jr., Ph.D., Associate Professor of Biological Chemistry

Rappaport, Ben Zion, B.S., M.D., Clinical Professor of Medicine

Rebhun, Lionel Israel, Ph.D., Instructor in Anatomy

Reed, Charles Allen, Ph.D., Associate Professor of Zoology

Reynolds, Samuel Robert Means, Ph.D., D.Sc., Professor of Anatomy and Head of the Department

Rosenthal, Sol Roy, M.D., Ph.D., Associate Professor of Preventive Medicine

Rostenberg, Adolph, Jr., A.B., M.D., C.M., Professor of Dermatology

Sadove, Max Samuel, B.S., M.D., Professor of Anesthesiology (Department of Surgery)

Samter, Max, M.S., M.D., Associate Professor of Medicine

Sanford, Heyworth Naylor, M.D., Professor of Pediatrics and Head of the Department

Saxton, George Albert, Jr., M.D., Director and Senior Physician in the Respiratory Center, with rank of Associate Professor

Scherr, George H., Ph.D., Assistant Professor of Microbiology

Schoenberger, James A., B.S., M.D., Clinical Assistant Professor of Medicine

Schour, Isaac, D.D.S., Ph.D., D.Sc., Professor of Histology, Head of the Department, and Dean of the College of Dentistry

Schwartz, Neena Betty, Ph.D., Lecturer in Physiology, with rank of Assistant Professor

Shaughnessy, Howard John, Ph.D., Professor of Public Health and Head of the Department

Sherrod, Theodore Roosevelt, Ph.D., M.D., Associate Professor of Pharmacology

Simer, Parke Harvey, Ph.D., Professor of Anatomy

Smith, Cedric Martin, M.S., M.D., Assistant Professor of Pharmacology

South, Frank Edwin, Jr., Ph.D., Assistant Professor of Physiology

Spellberg, Mitchell, M.S., M.D., Clinical Associate Professor of Medicine

Sreebny, Leo M., D.D.S., Ph.D., Associate Professor of Applied Materia Medica and Therapeutics

Sugar, Oscar, Ph.D., M.D., Associate Professor of Neurological Surgery

Susina, Stanley V., Ph.D., Assistant Professor of Pharmacology

Unna, Klaus Robert, M.D., Professor of Pharmacology and Head of the Department

Vicher, Edward Ernest, Ph.D., Associate Professor of Microbiology

Voigt, Ralph Ferdinand, Ph.D., Professor of Pharmacognosy and Pharmacology and Head of the Department of Pharmacognosy

Wakerlin, George Earle, Ph.D., M.D., Professor of Physiology and Head of the Department

Wallace, Donald Albin, Ph.D., Professor of Applied Materia Medica and Therapeutics

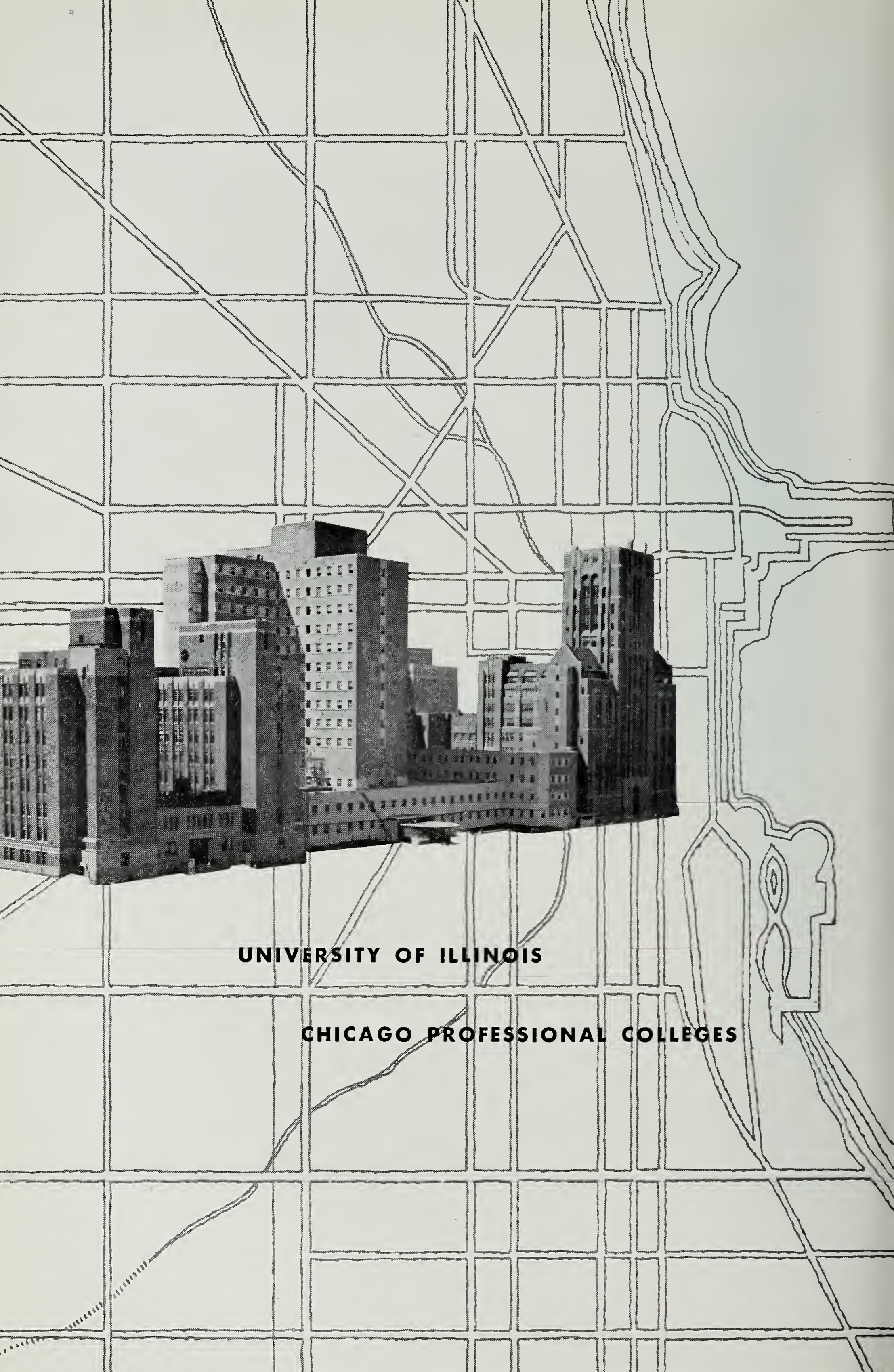
Webster, George Lewis, Ph.D., Professor of Chemistry and Head of the Department

Weinmann, Joseph Peter, M.D., Professor of Pathology and of Oral Pathology and Head of the Division of Oral Pathology

Whitehorn, William Victor, A.B., M.D., Professor of Physiology

Winzler, Richard John, Ph.D., Professor of Biological Chemistry and Head of the Department

Zimmermann, Arnold Albert, D.Sc., Professor of Anatomy



UNIVERSITY OF ILLINOIS

CHICAGO PROFESSIONAL COLLEGES

THE GRADUATE COLLEGE

The University of Illinois offers graduate instruction at its Chicago Professional Colleges leading to the degrees of Master of Science and Doctor of Philosophy in the basic sciences of anatomy, biological or pharmaceutical chemistry, microbiology, pathology, pharmacognosy, pharmacology, physiology, and certain applied science areas. The work is intended primarily for the training of men and women for teaching and research careers in the general health science area. Students who obtain graduate degrees in these areas are ideally oriented for positions on the basic science teaching staffs of dental, medical, and pharmacy schools.

The faculty members who teach graduate courses and act as advisers to graduate students are also members of the faculties of the Colleges of Dentistry, Medicine, and Pharmacy, and thus tend to emphasize the relationship between the basic medical sciences and their clinical applications.

Postgraduate refresher courses or other reviews of a strictly professional character are not included in the Graduate College and no credit toward a Master of Science or Doctor of Philosophy degree is allowed for any type of professional course, review, or routine. Professional work is not graduate work. Those interested in technical or advanced professional training will find opportunities for this kind of work in the postgraduate curricula offered in certain departments of the professional colleges.

LOCATION, HISTORY, AND ORGANIZATION

The Graduate College at the Chicago Professional Colleges is located in the Medical Center on the west side of Chicago. The campus, which is about three miles west of the downtown business area, is reached conveniently by elevated train or bus. The work of the College is centralized in the Dentistry-Medicine-Pharmacy buildings facing on Polk, Wood, and Wolcott Streets.

The University of Illinois offered facilities for advanced study and research in some fields as early as 1872. Organized graduate instruction under the name of the Graduate School, however, began in 1892. In 1894 the administration of the School was vested in the Council of Administration with the Vice-President of the University as Dean of the School. In 1906 the Graduate School was organized as a separate faculty and in 1947 it became known as the Graduate College.

Members of the faculty at the Chicago Professional Colleges were first appointed to the graduate faculty in 1924. An Associate Dean is responsible to the Dean of the Graduate College for graduate work conducted at the professional colleges. The teaching faculty includes all members of the University faculty who give instruction in approved graduate courses.

College policies pertaining to graduate work in the medical sciences are initiated by the Executive Committee of the professional colleges division of the Graduate College. Recommendations of this committee concerning faculty appointments and approval of courses and curricula in the Graduate College are submitted to the Executive Committee of the Graduate College at Urbana for approval.

Inquiries concerning graduate study in the basic medical, dental, and pharmaceutical sciences should be directed to the Associate Dean, Graduate College, University of Illinois, 808 South Wood Street, Chicago 12, Illinois.

Students interested in graduate study in areas other than those specified above should address their inquiries to the Dean of the Graduate College, University of Illinois, Urbana, Illinois.

OBJECTIVES AND STANDARDS

Graduate education is predominantly an intellectual adventure and has as its chief objective the encouragement of advanced intellectual achievement in the form of productive scholarship and research.

Graduate training is not a matter of successfully completing a number of advanced courses but emphasizes chiefly original laboratory or basic investigation. A major requirement for both the Master of Science and Doctor of Philosophy degrees is a thesis based on a research problem. Students must devote at least one-half of their time to the thesis. Degrees are granted to students (1) whose level of scholarship and investigative endeavor proves that they have mastered a definite field of knowledge and recognize its potentialities and opportunities for further advances, (2) who are able to integrate this knowledge with related domains of fact and understanding, and (3) who have proved themselves as independent and original scholarly investigators. The program, which is primarily one of training for research and teaching in the medical sciences, is entirely distinct from postgraduate training in the medical specialities.

High standards of admission are maintained, and careful selection and individual approval of faculty members is made to supply qualified advisers to graduate students. Laboratory, clinical, and library facilities are superior. Rigid tests in courses and examinations showing evidence of ability for productive research are requirements for normal progress toward a graduate degree.

ADMISSION

Admission to the Graduate College may be granted to graduates of institutions whose requirements for the professional or bachelor's degree are substantially equivalent to those of the University of Illinois, provided the undergraduate major is in biological science or chemistry or the undergraduate training includes organic chemistry, biology, and physics. A Bachelor of Science degree in pharmacy is required in some pharmacy disciplines.

Superior students registered in a professional college curriculum may be accepted on a highly selective basis.

Applicants should demonstrate a desire for graduate training in the basic medical sciences and should expect to make teaching and research in one of these branches a lifetime endeavor.

Each applicant must submit with his application for admission an official transcript of his college record and letters of recommendation from those who are acquainted with his previous academic record. In order to qualify for admission an applicant must have a scholastic average of at least 3.5[1] or its equivalent in his undergraduate work. For medical or dental graduates the average is based on both the preprofessional and professional record. After evaluation of all credentials, final acceptance is determined by the head of the department, who notifies the student and assigns him to an adviser. Registration is dependent on passing a mental and physical examination conducted by the University Health Service. Admission may be on probationary status which may be terminated at any time if the progress of the student is unsatisfactory. A student originally admitted on probation may be admitted to full status upon completion of the equivalent of a full quarter of satisfactory work (three units of A or B) in formal courses.

Before final admission is granted to applicants, they must take the Graduate Record Examination including the aptitude test and the advanced test in either biology or chemistry. These tests are administered at numerous centers throughout the country several times each year. To secure application forms and information concerning the time and place of the next examination, write to the Educational Testing Service, Princeton, New Jersey. Students who are currently pursuing the dental or medical curriculum or those who already have attained the Doctor of Dental Surgery or Doctor of Medicine degree are not required to take these tests. Provisional acceptance pending completion of the examination may be arranged with the Associate Dean.

Applicants must complete the following procedure before applications can receive final consideration:

1. Forward completed application forms to the Associate Dean of Admissions and Records.
2. Direct all institutions where academic work has been pursued to forward an official transcript to the Associate Dean of Admissions and Records.
3. Request two instructors most closely associated with the applicant's present field of interest to write letters of recommendation to the Associate Dean of the Graduate College.

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[1] Average halfway between B and C. Transcripts from institutions using a different grading scale are evaluated by the Associate Dean of Admissions and Records in terms of the University of Illinois system. Averages are computed on the following basis: A = 5; B = 4; C = 3; D = 2; E (failure) = 1.

4. Make arrangements to take the Graduate Record Examination and have the results forwarded to the Associate Dean of the Graduate College.

It is also desirable to arrange for a personal interview with the Associate Dean of the Graduate College and in certain instances it may be required.

Each applicant who is tentatively accepted should arrange with the University Health Service on this campus for a physical examination as promptly as possible. It is strongly urged that each applicant visit his own dentist and physician before registration, especially for (1) any needed dental work, (2) refraction and fitting for glasses if needed, (3) vaccination against smallpox, (4) typhoid immunization, (5) tetanus immunization, (6) diphtheria immunization or a booster, and (7) a chest X-ray. A Mantoux test for tuberculosis is also advisable. After registration the student will find it difficult to have these essential things done without loss of time from study.

The University Health Service offers emergency medical care to all students.

RESEARCH FACILITIES

The University buildings contain the administrative offices of the College, the library, lecture rooms, classrooms and large laboratories for classwork, numerous small laboratories for individual research, an autopsy amphitheater, and the clinics and hospitals. The last include the University of Illinois Research and Educational Hospitals and the Neuropsychiatric Institute. The Illinois Eye and Ear Infirmary is located near the campus. This infirmary is operated jointly by the University and the State Department of Public Welfare. Close to the college campus are the Cook County Hospital, Chicago-State Tuberculosis Hospital, West Side Veterans Administration Hospital, and Presbyterian-St. Luke's Hospital, all of which are used for student teaching and research.

The Research and Educational Hospitals, planned and built for teaching and investigation, connect directly with the classrooms and laboratories of the Colleges of Dentistry and Medicine. The addition, completed in 1953, increased the total capacity of the Research and Educational Hospitals and the Neuropsychiatric Institute to 810 beds. Each year there are approximately 200,000 patient visits in the outpatient clinics and 12,000 admissions to the hospitals. There are eleven surgical operating rooms, all with facilities for students and some equipped for special procedures. All types of surgery, including dental, are practiced.

The facilities of the Physical Environment Unit include rooms and an altitude chamber in which ranges of temperature, humidity, and pressure can be controlled, and basic medical and physiological instruments. They are available for use by any department or division of the University needing controlled environmental conditions for special research or instructional work.

The Drug Plant Experiment Station, located at Lisle, Illinois, provides unique opportunity for the development of drug plant research and the training of graduate students who are majoring in the field of pharmacognosy. The facilities of the Station are augmented by the very extensive plant culture programs of the Morton Arboretum.

LIBRARY

The library contains a comprehensive collection of standard and modern works on medical, dental, nursing, and pharmaceutical subjects, with over 1,100 current periodicals and more than 120,000 books on the shelves at present. It is used by professional men throughout the Chicago area, and its service to the University staff and student body is supplemented by loan arrangements with other libraries.

MUSEUMS

The College of Dentistry has a museum for the study and demonstration of the ecology of the masticatory structures, containing over 1,000 specimens.

The College of Medicine has two museums: the Anatomy Museum, including gross anatomy, histology, embryology, and neurology; and the Pathology Museum, including gross specimens for purposes of instruction of undergraduate and postgraduate students of medicine and dentistry.

The College of Pharmacy has a museum including more than 10,000 specimens of crude drugs and technical products. One collection is classified according to botanical origin and is arranged in cases illustrating habitat, commerce, etc. Another collection contains every drug officially listed in the *United States Pharmacopoeia* since 1820 and in the *National Formulary* since 1888.

RECREATIONAL FACILITIES

The social and recreational center for students, alumni, and faculty members is the Chicago Illini Union Building, 715 South Wood Street. Its facilities include a cafeteria, grill, soda fountain, browsing room, music room, gymnasium, meeting rooms, and game rooms. Intramural sports under a trained director are encouraged, and facilities and equipment are available for softball, touch football, horseshoes, tennis, archery, wrestling, fencing, badminton, basketball, handball, and ping pong. Through special arrangements, the swimming pools of the nearby Y.M.C.A. and Y.W.C.A. are available to students. An annual golf tournament is held at a nearby golf course.

MAIN READING ROOM OF THE LIBRARY OF MEDICAL SCIENCES

STUDENT HOUSING

Rooming facilities are available in University residence halls. Inquiries should be addressed to the Director of Housing, University of Illinois, 818 South Wolcott Avenue, Chicago 12, Illinois.

REGISTRATION AND PROGRAM OF STUDIES

Registration. Graduate students must register at the beginning of each quarter. Initial registration is permitted only after a student's application has been approved by the Graduate College and he has been accepted by a department which offers a curriculum leading to a Graduate College degree. Information concerning acceptance may be obtained at the Graduate College office after the application has been processed.

Upon acceptance a student obtains registration forms and instructions in the Graduate College office and is assigned his major adviser with whom he discusses his program of study and research. After obtaining the signature of the major adviser, the student obtains the signature of the instructor for each course. The registration forms are then submitted to the Associate Dean of the Graduate College for approval.

Admission to graduate courses is granted only to persons who have the requisite undergraduate work. The candidate registers for a certain number of graduate units. Each unit represents thirteen hours of laboratory work, or the equivalent, a week. One-half unit may be taken as the minimum each quarter, and three units constitute a full program.

Many courses for graduate students require some measure of previous preparation. A student who wishes to enter a particular course must satisfy the department concerned that he has had, either at the University of Illinois or elsewhere, the necessary preparation for admission to the course.

The credit value of graduate courses is given in units. Quarters in which courses are taught are indicated by F, W, Sp, or S representing fall, winter, spring, and summer, respectively.

Registration, including the payment of fees, must be completed before the close of the regular, scheduled day for this purpose.

Change of Program and Withdrawal. A graduate student is expected to plan his work carefully. When a change seems advisable, it may be permitted if approved by the major adviser, the instructors involved, and by the Associate Dean of the Graduate College. Simply ceasing to attend class does not constitute official withdrawal. If a student wishes to drop a course or to add other work, he must first secure an official change slip from the office of the Graduate College. Changes in program are permitted without fee if completed by a specified date. After the indicated date a fee of $1 is charged for each change. A student is not permitted to drop a course after the term is half finished if his grade in that course is C or below, unless he is willing to accept a grade of E therein. Exceptions may be made by the Associate Dean when justified.

A student who wishes to withdraw from the University must obtain a clearance form at the office of the Graduate College.

Change in Major Subject. A student who wishes to transfer from one department to another must secure and present to the Associate Dean the written approval of his present major department.

Unit Credit for Courses. Courses numbered from 300 to 399 are open to advanced undergraduate and graduate students, and those numbered 400 and above are open to graduate students only. Courses numbered below 300 do not carry graduate credit.

Graduate credit is measured in terms of units. One unit is considered the equivalent of five quarter hours. The normal program for a full-time graduate student is three units each quarter.

Transfer Students with Degree of Master of Science. Upon the recommendation of the head of the department of the major field of study and with the approval of the Associate Dean of the Graduate College, admission with advanced standing is granted to applicants who have completed a master's degree or the equivalent elsewhere and who desire to become candidates for the doctor's degree at the University of Illinois. If the applicant is admitted, his year of advanced study completed elsewhere is accepted as one year of residence, but the amount of credit to be accumulated at the University of Illinois before the candidate can be admitted to the preliminary examination can be determined only by the committee for the qualifying examination.

Courses Taken at Other Institutions. Students desiring to register for a course at another institution may do so only with the approval of the major adviser. If credit is to be used to meet requirements for a graduate degree, written approval of the adviser and the head of the department of the discipline involved must be presented to the Associate Dean of the Graduate College prior to registration for the course. When the course is completed, the appropriate amount of credit is accepted and recorded upon receipt of a transcript.

Graduate Study by Medical Students. At the completion of his first year in medicine, a student who has been in residence for one year and has maintained a B or 4.0 average in the College of Medicine for three quarters of medical work, may be permitted to register for three-fourths unit of graduate work each quarter concurrently with a full program of medical courses. Only students of excellent record are allowed this privilege. Registration may continue in following quarters as long as a 4.0 average is maintained in the medical curriculum.

Medical students who take advantage of this opportunity become familiar with the methods of research and advanced study and are granted credit by specialty boards for the basic science time credit requirement. Courses credited toward a professional degree can not be used for duplicate credit toward a graduate degree.

Medical students who wish to register for a full-time program of medical work or graduate work in alternate quarters must submit a program of study in advance for approval by the Associate Dean, noting the work to be taken in each quarter. In the case of assistants, the percentage time of employment should be noted in those quarters when service is to be rendered to the department.

Graduate Study by College Seniors. A college senior who has been in residence for at least three quarters and who is within five semester hours of his bachelor's degree may be admitted to the Graduate College if his grade-point average for the last fifty per cent of the hours completed is approximately 4.0. Seniors who meet these requirements and who wish to apply should submit an application for admission together with a letter from the dean of the undergraduate college specifying the hours needed to secure the bachelor's degree. If admitted to the Graduate College, the student carries as miscellaneous course work the hours needed to complete the requirements for the first degree; in addition, he registers for courses to be credited toward an advanced degree.

A senior who is within ten hours of the bachelor's degree may register in graduate courses for graduate credit if his grade-point average is that specified above and if he secures the approval of the head of the major department and the instructors concerned.

Graduate Study by Members of the Staff. Assistants, research assistants, residents, internes, and others on the University staff who undertake graduate study can not expect to complete their requirements for a degree as promptly as those who devote full time to their academic work. The academic programs of assistants and others on the University staff are limited by statute, and exceptions are permitted only occasionally for advanced students who file petitions with the Associate Dean and can show compelling reasons for such deviation. Those employed outside the University are expected to reduce their programs of academic work in accordance with these regulations. The maximum amount of work allowable is determined in accordance with the terms of employment as follows:

Full-time employment	1 unit
Three-quarter time employment	1½ units
One-half time employment	2 units
One-quarter time employment	2½ units

Individuals on the academic staff are not admitted as candidates for an advanced degree if they hold an appointment as Professor, Associate Professor, Assistant Professor, or Research Associate in any department or division of the University. Any person engaged in graduate study who accepts an appointment with the rank of Assistant Professor or higher is dropped as a degree candidate.

Graduate Study in the Summer. A full term of work is available during the summer quarter. Students in the professional colleges during the fall, winter, and spring quarters may register for full-time graduate work during the summer, provided they qualify for admission.

Time Limit for Completion of Degree. A candidate for the master's degree must complete all requirements for the degree within five years after his first registration in the Graduate College and a candidate for the doctor's degree within seven years after his first registration in the Graduate College, provided no intermediate master's degree is involved.

A candidate for the doctor's degree who has been awarded a master's degree either at the University of Illinois or elsewhere must complete all requirements for the doctorate within five years after his first registration in the Graduate College following receipt of his master's degree. The extension of the seven-year period stipulated above to a total of ten years is applicable only on condition that not more than one year of credit earned in connection with the master's program be counted toward the doctoral requirements.

Grades. Grades are recorded as follows: A, B, C, D, and E. A grade of E indicates a failure, and a grade of C or D indicates unsatisfactory, though passing, work. A student who receives two units of a grade below B must complete two additional units of A or B grade to qualify for a degree. Three units of a grade below B disqualify a student for further work at the graduate level.

A student is automatically placed on probationary status when he has acquired two units below a B grade. Such status appears on his transcript of record.

A failure or absence from an examination in any course in the major field precludes the conferring of the degree in the year in which the failure occurred.

Attendance at Commencement. Candidates for graduate degrees are expected to attend Commencement exercises in June.

Petitions. The normal procedures and requirements of the Graduate College are indicated in this catalog, but these may be modified occasionally for justifiable reasons. A student may petition the Associate Dean and the Executive Committee of the Graduate College for exceptions, but he should do so only after consultation with his adviser.

Advisers. Every graduate student must have an adviser. The adviser's primary duty is to assist the student in planning and carrying through a program of graduate work which fits the needs and desires of the student, and at the same time satisfies departmental and Graduate College requirements. A new graduate student should go to his major department to discuss the selection of an adviser.

THE DEGREE OF MASTER OF SCIENCE

Residence Requirements. A candidate for the master's degree is required to be in residence for the equivalent of at least three quarters. A student is in residence only when registered in the Graduate College and spending full time on the campus. Such a student earns one quarter of residence if he is registered for two units. Students in residence who are carrying lighter programs of work must spend a proportionately longer time in satisfying this requirement; thus, for example, a full-time assistant registered for one unit each quarter would discharge the residence requirement in six quarters. The time required to complete residence requirements and to attain the Master of Science degree is referred to as the "first year" of graduate study.

Study Program. Three units constitute a normal quarter program. A thesis and nine units must be completed for the degree. Only superior students are permitted to secure a degree with this minimum program. In all cases the student must satisfy the departmental requirements of his major department and major adviser and must earn at least four units in research courses and three units in formal courses.

Transfer of Credit. A graduate student who has completed graduate courses elsewhere may petition for transfer of credit. Such a transfer must not exceed three units of work and must have the recommendation of the head of the department in which the student is pursuing his program and the approval of the Executive Committee. In such instances the head of the department must be satisfied that the work is equivalent to the level of graduate courses offered by the University of Illinois. The petition is not considered by the Associate Dean until the general residence requirement of three quarters is fulfilled.

Major and Minor Subjects. A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor. Courses offered outside the major department may be included in the student's program if considered appropriate by the adviser. A major or a minor denotes the field of knowledge of a department or such part thereof as constitutes a separate and independent division of that field. For a master's degree, a major represents work totaling a minimum of four units. At least two units are required for a minor.

Foreign Language. A foreign language is not required for the Master of Science degree, but students contemplating work for the doctor's degree may make arrangements to satisfy requirements in one foreign language while they are candidates for the Master of Science degree. Satisfactory demonstration of knowledge of one foreign language must be completed before unit credit is allowed toward a Doctor of Philosophy degree.

Thesis. A candidate for a master's degree must submit a thesis on a subject approved by the professor in charge of his major work. Such approval must be secured, and the subject of the thesis filed at the office of the Graduate College not later than the beginning of the last quarter of residence.

Thesis Work in Absentia. A student may be permitted to complete the last two units of his work, if devoted to his thesis, under leave of absence. To receive such permission, the student must have accumulated at least seven units in residence, must petition for the privilege, and must submit to the Executive Committee an outline of the proposed investigation approved by the head of his major department and satisfactory evidence that adequate facilities are available at the place where he intends to do the proposed work. If the petition is approved, the student must register, pay tuition fees, and discuss his progress with his major adviser at frequent intervals.

Thesis Preparation. Specific written instructions for the preparation and form of the thesis are available at the Graduate College office. Special thesis paper is required, and title pages and envelopes must be printed. Two copies of the approved thesis are required, one for the University Library at Urbana and the other for the Library of Medical Sciences at Chicago. The thesis may be submitted at any time during the year; however, candidates who expect to receive a degree in June must meet the deadline indicated in the Calendar.

Oral Examination. Upon deposit of the thesis, a committee is appointed by the Associate Dean to examine the thesis and to determine the candidate's knowledge in the major and minor fields of study. Degrees are conferred at the June Commencement. Candidates must be recommended to the Associate Dean for the degrees indicated at least two weeks before the date set for the Commencement exercises (see Calendar).

Publication of the master's thesis is encouraged and does not require prior approval of the Graduate College.

Applications for Degrees. Each candidate for the degree of Master of Science must file an application for the degree on a blank provided for that purpose. For the dates of application and deposit of theses, consult the Calendar.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Admission by Qualifying Examination. Students desiring admission to graduate study beyond the Master of Science degree must file an application with the Graduate College. No student is admitted without the recommendation of a committee of three appointed by the Associate Dean to conduct a qualifying oral examination and prescribe a program of study and course work.

Period of Study. The normal minimum period of study required for the degree of Doctor of Philosophy is two years beyond the master's degree, during which the student is required to devote all of his working time to his studies. Both years must be spent in residence at some accredited educational institution. If the student has obtained his Master of Science degree at the University of Illinois, one of the two years may be spent in absentia, if approved by the Executive Committee. A student who has completed the first year of graduate work elsewhere must be in residence during the two remaining years. In exceptional cases, a student with two years of graduate study elsewhere who satisfies his major department that he has completed work equivalent to the standard departmental requirements is permitted to take his preliminary examination, provided he has fulfilled the language requirements. If such a student passes the preliminary examination, he may complete the requirements for the Doctor of Philosophy degree by devoting the third year to research in residence. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by a thesis and examination.

Residence Requirements. A student is in residence only when registered in the Graduate College and spending full time on the campus. Such a student earns one quarter of residence if he is registered for two or more units. Students in residence who are carrying lighter programs of work must spend a proportionately longer time in satisfying this requirement; thus, for example, a full-time assistant registered for one unit each quarter would discharge the residence requirement in six quarters of work. A student who is employed off campus is not considered to be in residence even though he is registered in a campus course.

Residence is designated by "years" as follows:

First "Year." The time required to complete the Master of Science degree.

Second "Year." The time required to progress from the completion of the Master of Science degree through the completion of the preliminary examination. This involves obtaining satisfactory grades in nine more units of graduate work, completion of the foreign language requirement, and passing the preliminary examination.

Third "Year." The time spent between passing the preliminary examination and the completion of all requirements for the doctor's degree, including nine additional units, writing a satisfactory thesis, and passing the final examination.

Major and Minor Subjects. A student who wishes to become a candidate for the degree of Doctor of Philosophy must earn a total of eighteen units beyond the master's degree. Nine units must be in non-research graduate courses, of which four units must be in the 400 series. Not more than two units of the required 400-series courses may be in seminar courses. Non-research courses completed in pursuit of the Master of Science degree may be applied to satisfy these requirements.

The student must pursue a major subject in the discipline in which his research lies. He is also required to choose one minor subject, or he may choose two. If only one minor is chosen, it must be taken in a discipline other than that of the major, and credit for it may be earned by work representing not less than four units. If two minors are chosen, one may be a subject closely related to the major. With the approval of the adviser, it may be a division of the major field of study. The other minor (not less than two units) must, in that case, be taken in a discipline other than that of the major. Units earned in the minor field while pursuing work toward the Master of Science degree may be counted in the total required for a minor. A student whose major is in a clinical department must select a minor in a basic science; the department head of the science chosen or his representative shall act as co-adviser to the student. At least two units of a minor shall consist of work in non-research courses.

In a Doctor of Philosophy program the minor must be selected in a discipline which has an approved curriculum leading to the Master of Science degree.

Registration in Basic Medical Science Courses. Upon arrangement by the major adviser with the Associate Dean, a student may pursue, without unit credit toward the degree, basic science courses not specifically required in the Doctor of Philosophy program. Grades obtained in such courses are not prejudicial to the student's standing in the Graduate College. It is obvious, however, that unsatisfactory grades may be detrimental to his general progress and standing in the area of his major and minor departments as determined by those departments.

The privilege of registering for additional basic science courses as stated above is curtailed if it appears that the student's intent is to meet the requirements of the medical curriculum thereby. Registration is not allowed for more than one such course each quarter on this basis.

Preliminary Examinations. A candidate for the Doctor of Philosophy degree must pass a preliminary examination intended to test his knowledge of his major and minor fields of study and to determine whether he is prepared for the final year of work. He is eligible to take the examination when (1) he has completed a Master of Science degree; (2) he has passed the two required language examinations; (3) he has satisfactorily completed nine units of work beyond the master's degree including four units in the minor; and (4) his adviser informs the Associate Dean that the candidate is adequately prepared in the major and minor fields.

The examination extends to the candidate's whole field of study. It is not confined to specific courses taken in this or other universities, but is conducted to determine whether the candidate has mastered a definite field of knowledge and is able to evaluate its potentialities and opportunities for further advances. The student must also satisfy the committee that he is able to integrate his field of specialization with the larger domains of knowledge and understanding. The examination is partly oral, and may be wholly so.

The student must complete two full quarters of residence between his preliminary examination and the completion of his work for the doctorate.

Final Examination. At least two weeks before the time when the degree is conferred (consult the Calendar for latest dates for final examinations), the candidate must submit to a final examination given by a committee appointed by the Associate Dean. This examination is primarily on the research work of the student as embodied in his thesis and is conducted chiefly to determine if the candidate has demonstrated the capacity to do original and independent scholarly investigations in the field of his choice, but is not confined to that alone. It is intended to verify also that the candidate has a satisfactory grasp of his major subject as well as an acquaintance with the field of knowledge pertaining less directly to it.

If, after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

Other Examinations. Before the candidate is admitted to the final examination and defense of his thesis, he may be required to take any other examination, oral or written, which is thought proper by the various departments in which he has studied.

The above examinations are in addition to those in the courses for which the student is registered, and must be taken at the times set by the major adviser.

Thesis. The ability for independent research must be shown by the production of an original thesis on some topic connected with the major field of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen and the title submitted to the Graduate College office not later than the first registration following successful completion of the preliminary examination.

Not later than two weeks prior to the final examination, and not less than four weeks before the time when the degree is to be conferred (see Calendar), two typewritten copies of the complete thesis and an abstract on thesis paper and in final form with title pages, envelopes, and certificates of approval, must be deposited in the office of the Graduate College. The style and form of the thesis and abstract must comply with the written instructions obtainable at the Graduate College office. After the thesis is checked in the Graduate College office, the student must arrange for each member of his doctoral committee to read the thesis before the date of the final examination.

Certificates. Each of the copies of the thesis must be accompanied by a certificate of approval. The certificate forms are available in the Graduate College office and must be signed by the person under whose immediate supervision the thesis was prepared and also by the head of the major department. In considering the deadline for submitting the thesis and abstract to the Graduate College in its final form, the adviser and student should allow the head of the department sufficient time to read both the abstract and the thesis before affixing his signature of approval to the certificates. These certificates must also be signed by the members of the examining committee immediately following the oral examination.

Microfilm Reproduction. In order to insure that theses are available for use by others, it is required that they be microfilmed. Each candidate who passes the final examination must pay a fee of $25.00 and deposit a typewritten abstract of his thesis of approximately six hundred words, together with the original and first carbon of the complete thesis. This fee provides for (1) microfilming of the complete dissertation, with one copy deposited in the University of Illinois Library, (2) publication of an abstract of six hundred words or less in *Dissertation Abstracts.*

The abstract is to indicate the method followed, the evidence used, and the conclusions reached in the investigation, and must follow the form generally used for publication of abstracts.

Publication of Thesis. Formal publication of the thesis, either in its entirety or in a condensed form, is not required. However, students should consider the advantages to them, and to their professional field, of publication of the significant methods and findings of their research in the technical literature. If published, the article or book should have a note indicating that the material is, or is based upon, a dissertation submitted in partial fulfillment of the requirements for the Doctor of Philosophy or Master of Science degree at the University of Illinois.

Application for Degree. Each candidate for the Doctor of Philosophy degree must file an application for the degree on a blank provided for that purpose. Application is made at the time the thesis is submitted in final form to the Associate Dean. Degrees are conferred in June.

FELLOWSHIPS

A student on fellowship appointment must register in the Graduate College and must pursue a program of academic study and research leading to a graduate degree. Stipends paid to the individual are not for definite services performed for the University, but are to provide living expenses while the approved course of study or research is being pursued. Fellows must devote full time to such activities, and no teaching, proctoring, grading of papers, or other routine duties are required of them.

Fellows are selected by the Graduate Fellowship Committee on the basis of scholarship and promise in teaching or research as revealed by transcripts, letters of reference, and recommendations by the major departments. Successful applicants will receive a notice of appointment on or about April 1 and are expected to accept or decline by April 15. (See statement of policy adopted by the Association of American Universities under Assistantships on page 29.) At the time an award is accepted at the University of Illinois, the Fellow agrees that without the consent of the Associate Dean of the Graduate College he will neither engage in any outside employment for remuneration nor hold concurrently any other fellowship carrying a stipend.

University Fellowships are awarded annually through the Graduate College for the Chicago Professional Colleges. Stipends of $1,500 for applicants with a bachelor's degree, $1,800 for those with a master's degree, and $2,000 for medical or dental graduates are available. The stipends are awarded for a twelve-month period and include exemption from the tuition fee.

Fellows are eligible for reappointment in competition with new applicants. Fellowships provide an opportunity for research training in the basic sciences, or in the application of these sciences to clinical investigation. They are intended primarily for graduates who are in the early stages of their preparation for a teaching and research career. Fellowships are not intended to provide stipends for those pursuing professional specialty board requirements or for those pursuing advanced work of a professional character.

Application forms may be obtained from the office of the Associate Dean and must be submitted by March 15 for appointments which become effective on the following July 1 or September 1. Applications should be mailed to the Associate Dean of the Graduate College, 808 South Wood Street, Chicago 12, Illinois.

The American Foundation for Pharmaceutical Education, 330 West 42nd Street, New York 18, New York, offers support in the nature of a stipend and payment of tuition to selected students who may choose to conduct their graduate work at the University of Illinois. Applications are made directly to the Foundation.

Attention of all graduate students is directed to fellowship support offered by federal agencies such as the National Research Council, Washington 24, D.C., the National Institute of Health, Bethesda, Maryland, and the National Science Foundation. A student should apply directly to those agencies and may obtain approval to conduct his work at the University of Illinois if accepted as a graduate student.

Many foundations and private agencies also make available fellowship stipends for graduate students who have initiated their studies. Inquiries may be made at the Graduate College office.

A number of summer fellowships are available for professional or graduate students who begin graduate programs in the summer. Stipends of $500 plus exemption from tuition are awarded to a limited number of applicants on a competitive basis.

SCHOLARSHIPS

Acts of the General Assembly provide scholarships for veterans of World War I and World War II who are not receiving financial assistance for educational purposes from the federal government and who, at the time of enlistment, were residents of Illinois or students in the University of Illinois. These scholarships exempt the holders from the tuition fees in any department of the University. The General Assembly also has established one scholarship in each county for descendants of veterans of World War I and one scholarship for descendants of veterans of World War II. These scholarships are awarded by competitive examination held on the first Saturday in April.

ASSISTANTSHIPS

A number of departments offer half-time assistantships carrying an annual minimum stipend of $1,800. Assistants are required to perform services for the University in the nature of grading papers, proctoring, and assisting in laboratory teaching or research. Research assistants also are assigned to specific projects supported by outside funds.

Applicants should apply directly to the department after ascertaining their eligibility for graduate work. Assistants must carry a reduced study schedule as indicated on page 19 of this catalog, but the greater length of time required to complete the degree is compensated for by the additional gain in teaching and research experience.

The University of Illinois adheres to the following resolution adopted by the members of the Association of American Universities and a number of other graduate schools of North America:

"In every case in which a graduate assistantship, scholarship, or fellowship for the next academic year is offered to an actual or a prospective graduate student, the student, if he indicates his acceptance before April 15, will still have complete freedom through April 15 to reconsider his acceptance and to accept another fellowship, scholarship, or graduate assistantship. He has committed himself, however, not to resign an appointment after this date unless he is formally released from it."

FEES AND EXPENSES

Students registering for graduate work pay fees according to the following schedule:

QUARTER FEES	*Regular Schedule (over two units)*	*Reduced Schedule (two units or less)*
Tuition Fee		
Residents of Illinois	$ 50.00	$24.00 per unit
Nonresidents of Illinois	167.00	80.00 per unit
Laboratory, Library, and Supply Fee	7.50	7.50
Union Building Service Charge	3.50	3.50

Students registered for one unit or less are exempt from this fee.

SPECIAL FEES

Late Registration Fee .... $ 5.00

Former students who register after the regular registration days are subject to this fee.

Change of Program Fee 1.00

This fee is charged for every change slip issued at the request of the student.

"In Absentia"

Students enrolled for thesis work for the master's or doctor's degree on leave of absence pay the regular tuition fee only, as listed above.

Special Examination Fee 10.00

This fee is charged for any special examination given in a course which has been failed.

Listener's Fee 10.00

All persons with University appointments, all students not registered for a reduced schedule, and those students who occasionally attend classes or seminars as listeners are exempt from this fee. All other persons must pay this fee for each course.

Transcript Fee 1.00

Each student who has paid all his University fees is entitled to receive, without charge, one transcript of his record. For each additional transcript the fee is $1.00.

Service Charge for Deferred Fees

A service charge of 10 per cent of the amount of fees deferred, but not to exceed $2.00 per quarter, is charged for the privilege of deferring fees. If deferred fees are paid in full within ten days after registration, the service charge is refunded except that a minimum service charge of $1.00 is retained by the University in all cases. The service charge, not less than one-third of the current quarter's fees, and all fees and charges from previous terms must be paid on the day of registration.

Fees for Fellowship Appointees

Graduate fellows whose stipends are paid from general appropriations of the University are exempt from fees. This does not apply, however, to fellows whose stipends are paid from grants received by the University from outside sponsors of graduate study and research.

Fees for Medical Students

Students registered concurrently for graduate work and full-time medical work are exempt from graduate fees.

Fees for Persons on the University Staff

Members of the academic, administrative, or permanent nonacademic staff of the University of Illinois may register in University courses without payment of the tuition fee and the laboratory, library, and supply fee, provided that their annual salary for nine months is less than the minimum salary established for full-time assistants ($3,600) and they are rendering at least 25 per cent time service to the University. For persons employed on a twelve-month basis, the upper limit of this exemption is $4,400.

FIELDS OF INSTRUCTION

Courses open to graduate students are of two classes. Those numbered from 300 to 399 are open to advanced undergraduate and graduate students. Those numbered 400 and above are open to graduate students only.

Many courses for graduate students require some measure of previous preparation. A student who wishes to enter a particular course must satisfy the department concerned that he has had, either at the University of Illinois or elsewhere, the necessary preparation for admission to the course.

The credit value of graduate courses is given in units. Quarters in which courses are taught are indicated by F, W, Sp, or S representing fall, winter, spring, and summer, respectively.

Anatomy

The Department of Anatomy offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. Graduate work in anatomy deals with the origins and the morphological relations of structures, the structural characteristics of tissues, and relationships between structure and function.

To qualify for admission to graduate study in anatomy, the applicant must be an outstanding student who has received his bachelor's degree. Candidates for a master's degree must take histology (Anatomy 302) and neuroanatomy (Anatomy 303). Candidates with the degree of Doctor of Medicine or Doctor of Dental Surgery are not required to take elementary histology or neuroanatomy. In addition to histology and neuroanatomy, candidates for a master's degree may attend the Seminar in Anatomy (Anatomy 491) and, after consultation with the staff, may take courses for credit as minors in the fields of physiology (Physiology 324 and 325), biological chemistry (Biological Chemistry 301 and 302), pathology (Pathology 325), or from other courses offered in the Department of Anatomy. The basic science courses must be completed during the first year of study.

Candidates for the Doctor of Philosophy degree must take gross anatomy (Anatomy 301) during their first year, if possible. It is recommended that a candidate complete some courses in each of the basic medical sciences. During the first year, candidates must also take Techniques of Anatomical Research (Anatomy 421, 422, and 423). In the second and third years, they must take Concepts of Morphology (Anatomy 410, 411, and 412). In the second year, an area for thesis research must be elected under Anatomy 493.

The thesis is based on the problem selected for investigation, and the usual standards for both Master of Science and Doctor of Philosophy degrees are required. Much latitude is allowed in the choice of problems for investigation. Any problem may be considered if it relates to embryogenesis, differentiation, morphology, histology, cytology, or neuroanatomy, either as a morphological problem, a cytological or histological one, or as a physiological or chemical one, provided it bears on the interdependence between function and structure. The doctoral thesis and, with only rare exceptions, the master's thesis, must be based upon experimental methods.

GRADUATE TEACHING FACULTY

Professors: Samuel R. M. Reynolds (Head of Department), Gerhardt von Bonin, Isaac Schour, Parke H. Simer, Arnold A. Zimmermann.

Associate Professors: Robert H. Krehbiel, James C. Plagge.

Assistant Professors: Arthur LaVelle, Harry Monsen.

Instructor: Lionel I. Rebhun.

COURSES FOR GRADUATES

301. Gross Human Anatomy. Regional and systematic dissection of the human body. Functional and applied considerations. F, W, Sp; 3 units (1 unit each quarter). Staff.

302. Human Histology. Morphology and functions of cells and fundamental tissues. Laboratory and conferences. F, W; 2 units (1 unit each quarter). Staff.

303. Human Neuroanatomy. Anatomy and functions of the human nervous system; architecture of the nervous system and the functions of the nervous pathways. Laboratory and lectures. Sp; 1 unit. Staff.

350. Clinical Anatomy. Topographical emphasis. F, W, Sp; ½ unit. Staff.

410. Concepts of Morphology. Weekly group discussion of development of concepts in anatomy in selected areas. Three hours (once weekly). F; ½ unit. Staff.

411. Concepts of Morphology. Continuation of Anatomy 410. W; ½ unit. Staff.

412. Concepts of Morphology. Continuation of Anatomy 411. Sp; ½ unit. Staff.

421. Techniques in Anatomical Research. Technical procedures currently used and taught on a demonstration and practice basis by the staff. Includes cytological, tissue culture, electron microscopy, surgical, histological techniques, and other procedures. F; ½ unit. Staff.

422. Techniques in Anatomical Research. Continuation of Anatomy 421. W; ½ unit. Staff.

423. Techniques in Anatomical Research. Continuation of Anatomy 422. Sp; ½ unit. Staff.

491. Seminar in Anatomy. Presentation and discussion of individual investigations by members of the department and others; reviews of important contributions in morphologic investigation. F, W, Sp; ¼ unit each quarter. One seminar presentation a year required for credit.

493. Research in Anatomy. Research in any of the basic divisions. F, W, Sp, S; ½ to 3 units each quarter.

Biological Chemistry

The objectives of the Department of Biological Chemistry in offering graduate training are (1) to develop teachers of the subject for universities and for colleges of medicine, dentistry, and pharmacy, (2) to develop investigators in this field and the allied biological sciences, (3) to help provide an environment for better teaching of professional students in the medical sciences at the University of Illinois, and (4) to aid the academic staff in the department in obtaining new knowledge through research endeavor.

In general, the admission requirements are those which apply to all applicants for graduate work at the professional colleges. Since the approach to biological chemistry may be either primarily chemical or biological, the requirements for graduate work in the department are flexible enough to permit admission of individuals of quite different backgrounds. The undergraduate training should include sixteen semester hours of chemistry, including organic, quantitative analysis, and physical chemistry; eight semester hours of physics, including laboratory work in electricity, heat, mechanics, and sound; at least one thorough course in biology; and at least six semester hours of German or French. Students having a bachelor's degree, including the above minimum course requirements, as well as medical and dental graduates or students pursuing these professional degrees, are eligible to apply for graduate work in the department.

Candidates for the Master of Science degree in biological chemistry are required to take Biological Chemistry 301, 302, 491, and 493 (four units). Of the nine units required for the Master of Science degree, at least one unit must be taken in basic courses offered in anatomy, chemistry, microbiology, pathology, pharmacology, or physiology, and one unit in advanced courses in biological chemistry.

Candidates for training beyond the degree of Master of Science must have earned this degree or met the requirements for this degree in the Graduate College or completed work of equivalent value elsewhere. The requirements for the Doctor of Philosophy degree include Biological Chemistry 301, 302, 410, 420, 421, 491 (one unit), and 493 (nine units); Physiology 324 and 325 (under special circumstances, two units of another basic science course may be substituted for physiology); Chemistry (Pharmaceutical) 301, 401, and 402. The remaining courses must be selected to complete an appropriate minor of four units and a total requirement of eighteen units beyond the master's degree.

A split minor in biological chemistry must include at least one-half unit of Biological Chemistry 491 and one-half unit of another 400-level course in the department (other than Biological Chemistry 493). A full minor must include at least one unit of Biological Chemistry 491 and one unit of other 400-level courses in the department (other than Biological Chemistry 493).

The thesis and language requirements must conform to the general requirements of the Graduate College, and the thesis must be of sufficient merit to warrant publication in full or in part in a recognized chemical journal.

GRADUATE TEACHING FACULTY

Professors: RICHARD J. WINZLER (Head of Department), STEPHEN B. BINKLEY, DOUGLAS A. MACFADYEN.

Associate Professors: LEO G. ABOOD, MAX K. HORWITT, MAX E. RAFELSON, JR.

Assistant Professors: CLARENCE A. JOHNSON, PAUL KOHN, TERRELL C. MYERS.

COURSES FOR GRADUATES

301. Biological Chemistry. Chemistry of the constituents of tissues and body fluids, and current methods for their qualitative and quantitative determination; digestion, absorption, and intermediary metabolism of lipids, proteins, and carbohydrates in health and disease, and the role of hormones, vitamins, and enzymes in the regulation of these processes; the application of this knowledge to the problems of disease. Lectures, conferences, and laboratory. F; 1 unit. Staff.

302. Biological Chemistry. Continuation of Biological Chemistry 301. Lectures, conferences, and laboratory. W; 1 unit. Staff.

331. Biological Chemistry. Comparable to Biological Chemistry 301. Lecture, laboratory, and conferences. W; 1 unit. Staff.

332. Biological Chemistry. Continuation of Biological Chemistry 331 and comparable to Biological Chemistry 302. Lecture, laboratory, and conferences. Sp; 1 unit. Staff.

410. Biochemical Preparations. A laboratory course involving the preparation of biologically important substances and the evaluation of their purity. S; ½ unit. Prerequisite: Biological Chemistry 301 and 302, or equivalent. Abood.

420. Intermediary Metabolism of Carbohydrates. An advanced course considering in detail the chemistry and intermediary metabolism of carbohydrates. The production and utilization of energy, the enzyme systems involved, and the intermediates encountered in biological systems are considered. Lectures. Sp; ¾ unit. Prerequisite: Biological Chemistry 301 and 302, or equivalent.

421. Intermediary Metabolism of Nitrogen Compounds. An advanced course considering in detail the intermediary metabolism of the biologically important lipids, amino acids, proteins, and nucleic acids. Lectures. F; ¾ unit. Prerequisite: Biological Chemistry 301, 302, and 420, or equivalent. Rafelson.

430. Nutrition. Historical development of modern nutritional concepts of the role of the vitamins, amino acids, fat, and inorganic salts in metabolic processes. Special emphasis on current research. Lectures. S (alternate years); ½ unit. Prerequisite: Biological Chemistry 301 and 302, or equivalent. Horwitt.

440. Special Topics in Biochemistry. An advanced course dealing with selected topics in biochemistry. The particular subjects vary from year to year. One to three topics are considered each time the course is given. Topics include: biochemistry of the hormones, chemistry and function of steroids, biochemical genetics, chemistry of enzymes, phytochemistry, etc. Lectures. Sp; ½ unit. Perquisite: Biological Chemistry 301 and 302, or equivalent. Staff.

491. Seminar in Biological Chemistry. Student and faculty presentation of assigned subjects of current importance in biological chemistry and related fields. Assigned reading. F, W, Sp; ½ unit each quarter.

493. Research in Biological Chemistry. Research on problems of biological importance with members of the graduate staff. F, W, Sp, S; ½ to 3 units each quarter.

Chemistry (Pharmaceutical)

Graduate education in pharmaceutical chemistry is a necessary part of a program to advance rational medication in the health sciences. Opportunities for the employment of the specialized knowledge acquired by graduate training in this field are available in the pharmaceutical industry in the synthetic development of new medicinal agents, the creation of new and stable dosage forms, the qualitative and quantitative evaluation of natural and synthetic drugs, the protection of quality in the manufactured product, the improvement of production processes, and the interpretation of the physical sciences to the health professions and the public. Equally important opportunities are available in the field of pharmaceutical education where a presently acute and always steady demand for teachers with this type of specialized education exists.

Admission to graduate study in pharmaceutical chemistry is subject to the general regulations of the Graduate College. The applicant, if a pharmacy graduate, must have received the degree of Bachelor of Science in Pharmacy from a college or university approved by the Graduate College of the University of Illinois. His undergraduate program should have included, among other things: (1) thirty-six semester hours of undergraduate courses in chemistry, including at least ten hours of general inorganic chemistry and qualitative analysis, four hours of quantitative analysis, eight hours of organic chemistry, and three hours of physical chemistry; (2) eight semester hours of general physics; (3) six semester hours of college mathematics; and (4) at least one course in biology.

All students enrolled for their first year of graduate study are examined on their knowledge of the fundamental principles of inorganic, analytical, physical, and organic chemistry, and their ability to correlate these principles. Examinations in these subjects are offered during the latter part of the spring quarter each year. The results of these departmental examinations are the basis for admission to the regular oral examination for the master's degree.

Of the minimum nine units required for the Master of Science degree in pharmaceutical chemistry at least four units must be completed in formal course work acceptable for graduate credit and at least four units must be completed in work leading to the production of an acceptable thesis (Chemistry 493). If, in the judgment of the major adviser, the undergraduate background is incomplete, the applicant may be required to complete more than the minimal number of units in course work before a thesis subject is completed.

Applicants for admission to a program of study leading to the degree of Doctor of Philosophy in pharmaceutical chemistry are subject to the general rules of the Graduate College.

The minor field of study may be selected from microbiology, pharmacognosy, pharmacology, and pharmacy.

An acceptable thesis must be presented as the result of original investigation in the major field of study.

All graduate study programs in pharmaceutical chemistry are under the general supervision of the head of the Department of Chemistry. The applicant may select any member of the graduate faculty in the department as his major adviser. The major adviser has immediate supervision of the applicant's program of study, subject to the approval of the head of the department.

A departmental examination which is partly written and partly oral is required of graduate students majoring in pharmaceutical chemistry at the end of the second year of graduate study. This examination is designed to demonstrate the student's knowledge of modern theory and practice in the field of chemistry and his ability to present that knowledge in an oral exposition of his projected line of research. On the basis of the quality of the performance, the major adviser may recommend the student for examination by the preliminary committee in the immediate future or may recommend further preparatory study.

GRADUATE TEACHING FACULTY

Professors: George L. Webster (Head of Department), Ernst R. Kirch.

Associate Professors: Charles W. Clarke, James E. Gearien, Norman R. Joseph, Alfred J. Perkins.

Assistant Professors: Ludwig Bauer, Ralph Daniels.

COURSES FOR GRADUATES

301. **Qualitative Organic Analysis.** A study of the physical and chemical properties of organic compounds, their classification reactions and methods of synthesis of typical derivatives which lead to the identification of individual compounds. Two conferences and a minimum of ten hours laboratory each week. Offered to classes of four or more students after consultation with the head of the department. F, W, Sp, S; 1 unit. Prerequisite: One year of organic chemistry. Gearien.

303. **Advanced Drug Assay.** Conferences, library, and laboratory work related to the methods of detecting impurities which develop and determining the quality of drugs during storage, the improvement of existing methods of assay of drugs, or the development of new assays or new types of assays. F, W, Sp, S; ½ to 2 units. Prerequisite: Quantitative analysis, drug assay, chemistry of synthetic drugs, chemistry of natural products. Kirch.

304. **Phytochemistry.** Lectures, library, and laboratory work in the properties and suitable methods of isolation and purification of typical examples of plant constituents. Lectures and library work may be elected without laboratory, but students electing laboratory work must elect the lectures either simultaneously or as a prerequisite. Offered to classes of four or more students. F, W, Sp, S; ½ to 2 units. Prerequisite: Drug assay and chemistry of natural products. Kirch.

316. **Physical Chemistry, Chemical Kinetics, and Catalysis.** Discussion of reaction velocities in homogeneous and heterogeneous systems with special emphasis on the application of kinetic methods to the study of reaction mechanisms; theories of catalysis and adsorption phenomena. F; ½ unit. Prerequisite: Chemistry 340. Perkins.

317. **Physical Chemistry, Atomic Structure, and Chemical Bond.** Discussions of the electronic structure of matter leading to modern theory of valence and the chemical bond; spectra of atoms and molecules; physical properties as related to molecular structure. W; ½ unit. Prerequisite: Chemistry 340. Perkins.

342. **The Chemistry of Synthetic Drugs.** A study of modern synthetic drugs with regard to their nomenclature, methods of synthesis, relation to other drugs having similar therapeutic properties, physical and chemical properties. Four lectures each week. F; ½ unit. Prerequisite: One year of organic chemistry. Webster.

343. **Chemical Toxicology.** A course concerned with the common sources; chemistry of the physiological action, methods of isolation, and identification of toxic agents commonly encountered as industrial hazards and as the cause of accidental or purposeful poisoning. Two lectures and three three-hour laboratory periods each week. Sp; ½ unit. Prerequisite: Organic chemistry and concurrent registration in pharmacology. Webster.

346. **Synthesis of Drugs.** A continuation of the study of organic chemistry with practice in and emphasis on the application of general and special reactions

to the synthesis of drugs. Lectures, library, and laboratory. Two lectures and three three-hour laboratory periods each week. F; ½ unit. Prerequisite: One year of organic chemistry. Gearien.

349. **Pharmaceutical Assaying.** Chemical and physical methods of analysis of raw materials and dosage forms of medication involving the principles of sampling and quantitative separation of active compounds from inactive diluent or vehicle or from other active components. Two lectures or conferences and three three-hour laboratory periods each week. W, Sp; ½ unit. Prerequisite: Drug assay. Kirch.

350. **Instrumental Analysis.** The principles, methods, and techniques of analytical chemistry using modern electrical and electronic instruments. Three lectures and two three-hour laboratory periods each week. W; 1 unit. Prerequisite: Physical chemistry, quantitative analysis, organic chemistry, and physics. Clarke.

401. **Advanced Organic Chemistry — Reactions.** A study of the mechanisms and applications of organic chemical reactions used in synthesis. Three lectures each week. Offered to classes of four or more students. F, W, or Sp; ½ unit. Prerequisite: One year of organic chemistry. Daniels.

402. **Advanced Organic Chemistry — Theory.** A study of the theories of organic chemical reactions and structure. Lectures and library work. Three lectures each week. Offered to classes of four or more students. F, W, or Sp; ½ unit. Prerequisite: One year of organic chemistry. Daniels.

403. **The Chemistry of Heterocyclic Compounds.** Lectures and assigned reading and problems on the occurrence, nomenclature, reactions, and methods of synthesis of the heterocyclic compounds containing oxygen, sulfur, and nitrogen. F, W, or Sp (odd numbered years); ½ unit. Prerequisite: One year of organic chemistry. Bauer.

404. **Advanced Inorganic Chemistry.** A systematic study of the elements based upon the periodic table and of current thought on the nature of the chemical bond. Sp (even numbered years); 1 unit. Perkins.

405. **Introduction to Chemical Thermodynamics.** An introduction to the fundamental theory of thermodynamics with emphasis on its application to chemical problems. Sp (odd numbered years); ½ unit. Prerequisite: Physical chemistry. Perkins.

408. **Principles and Applications of Stereoisomerism.** A study of the theoretical aspects of optical isomerism, geometrical isomerism, and conformational analysis and their practical applications to stereo selective reactions. W; ½ unit. Prerequisite: Chemistry 148 and 346. Daniels.

409. **Vitamin Assay.** Methods for determining vitamins in pharmaceutical and food products by the use of the spectrophotometer and fluorophotometer; microbiological methods for determining vitamins and other nutrilites. Three conferences and ten to twelve laboratory hours each week. F, Sp, or S; 1 unit. Kirch.

491. **Seminar in Pharmaceutical Chemistry.** Weekly reviews, reports, and discussions of topics drawn from the literature of chemistry or from research. F, W, Sp; ½ unit each quarter.

493. **Research in Pharmaceutical Chemistry.** Individual research under the direction of a member of the staff. F, W, Sp, S; ½ to 3 units each quarter.

Histology (Dentistry)

The Department of Histology offers work toward the degree of Master of Science in histology. The program is devised to provide training for teachers and investigators in the field of histology as it applies more specifically to the basic sciences related to dentistry. A student, however, is required to have a knowledge of the entire field of histology as it applies to the human body.

In addition to the general requirements of the Graduate College, the applicant must have received his Doctor of Dental Surgery degree. In certain cases an undergraduate dental student with a bachelor's degree may be accepted providing he has maintained at least a B average and has completed at least three quarters of the dental curriculum. Nonprofessional students are not accepted.

Course requirements include Histology 401, a total of three units of non-research credit other than in seminars, and at least four units in Histology 493 and 494. Attendance at the Oral Research Seminar is required but does not carry graduate credit.

A thesis on an original investigative problem is required.

Students completing the requirements for the master's degree in histology may apply for admission for work toward the Doctor of Philosophy degree in the Department of Anatomy and must comply with requirements of that department for the doctorate.

GRADUATE TEACHING FACULTY

Professor: Isaac Schour (Head of Department).

Assistant Professor: Roy J. Gillette.

COURSES FOR GRADUATES

401. **Advanced Oral Histology.** Lectures, discussions, and laboratory work pertaining to special subjects and problems in oral histology. F; ½ to 1 unit. Prerequisite: Histology 305, 328, and 329, and/or equivalent. Gillette.

402. **Advanced Oral Histology.** Continuation of Histology 401. W; ½ to 1 unit.

403. **Advanced Oral Histology.** Continuation of Histology 402. Sp; ½ to 1 unit.

493. **Research in Microscopic Anatomy of Teeth and Related Structures.** F, W, Sp, S; ½ to 3 units each quarter. Prerequisite: Histology 305, 328, 329, and/or equivalent.

494. **Research in Experimental Histo-Physiology of Teeth and Investing Tissues.** F, W, Sp, S; ½ to 3 units each quarter. Prerequisite: Histology 401.

Medicine

The Department of Medicine offers work leading to the Master of Science degree. The program is designed to afford training for a keener approach to the theory of medicine by emphasis on basic sciences, to provide experience in research method in the clinical field, and to develop clinical teachers who will have greater promise of rendering instruction to medical undergraduates.

A Doctor of Medicine degree is required for admission in addition to the usual requirements of the Graduate College, with the exception that currently registered medical students may be accepted if they have completed at least three quarters of the medical curriculum with a minimum average of 4.0. Such students will not be eligible for the master's degree until they have received the Doctor of Medicine degree. Clinical work carries no graduate credit.

Three units of formal graduate course work in the basic sciences is required, four units in Medicine 493 and at least one seminar per quarter for three quarters in one of the basic sciences as follows: Anatomy 491, Biological Chemistry 491, Microbiology 491, Pathology 491, Pharmacology 491, Physiology 491. Attendance at staff conferences and ward rounds as determined by the department is required.

The thesis must conform to standard requirements of the Graduate College and be of such merit as to warrant publication in part or in full in an acceptable scientific or clinical journal.

GRADUATE TEACHING FACULTY

Professors: Harry F. Dowling (Head of Department), S. Howard Armstrong, Jr., Carroll L. Birch, Edmund F. Foley, Ford K. Hick, Robert M. Kark.

Associate Professors: George G. Jackson, Louis R. Limarzi, Max M. Montgomery, Isadore Pilot, Ben Z. Rappaport, Max Samter, Mitchell A. Spellberg.

Assistant Professors: Harry A. Bliss, James A. Schoenberger.

COURSES FOR GRADUATES

493. Research in Medicine. F, W, Sp, S; ½ to 3 units each quarter.

Microbiology (Bacteriology)

The plan for graduate training of bacteriologists at the professional colleges, while it does emphasize the medical, dental, and pharmaceutical aspects, recognizes the fact that fundamental work in the whole field of bacteriology is essential to a concrete approach to the many unsolved problems in the field. Proper background in chemistry, including biological chemistry, biometrics, and physiology, is a definite asset to an understanding of the biology of bacteria and their interrelationships to other living things. While investigative work frequently follows medical lines, students are required to encompass the entire field of bacteriology including the related microorganisms such as the viruses, fungi, and rickettsia, and the immunological, physiological, genetic, and biochemical principles which involve each group. A broad knowledge of the field is required. Specialization in virology, mycology, or immunology is incidental as it pertains to the student's research effort and thesis.

The program is designed to achieve the following objectives: (1) training for future careers in medical research and teaching, (2) training of bacteriologists in the fundamental and applied techniques in diagnostic work, and (3) training of investigators for research positions, especially those involved in the development of new biologicals and anti-bacterial agents.

Applicants are considered in the order of the qualifications presented. Minimum requirements are those that apply to all applicants. Selections are made from applicants who have the best backgrounds as determined by a departmental committee. Selection of applicants for work for the Doctor of Philosophy degree is made from those who have obtained master's degrees in the department except in very exceptional cases.

To secure a firm foundation in bacteriology, the student is required to take certain courses and urged to attend various seminars in other departments and to do systematic reading and study.

For the Master of Science degree, Microbiology 320 and 325 are required. Four units must be earned in Microbiology 493 and two units in other formal microbiology courses in the 400 group. A student who anticipates applying for work toward the Doctor of Philosophy degree should first complete Biological Chemistry 301, 302, and Public Health 401.

For the Doctor of Philosophy degree, a minimum of seven units of didactic course work including those applied to the Master of Science degree are required. Suggested courses include Biological Chemistry 420 and 421, Physiology 324, 325, 326, and Chemistry 409. At least nine units must be in research courses. Four units in a suitable minor as approved at the time of the qualifying examination are required. The usual Graduate College requirements which apply to all students at this level of training apply to the candidate for a Doctor of Philosophy degree.

GRADUATE TEACHING FACULTY

Professors: MILAN V. NOVAK (Head of Department), J. EMERSON KEMPF.

Associate Professors: ESTHER MEYER, EDWARD E. VICHER.

Assistant Professors: LEON J. LE BEAU, ABRAHAM S. MARKOWITZ, GEORGE H. SCHERR.

Lecturer: GEORGE F. FORSTER.

COURSES FOR GRADUATES

320. **Bacteriology and Related Microbiology.** A study of the general morphology, metabolism, serology, and pathogenicity of the important microbial agents of communicable diseases; action of germicidal agents, sulfonamides, penicillin, streptomycin, and other antibiotics; factors in parasitic offense and mechanisms of host defense; detailed consideration of pathogenic bacteria. Three lectures and six hours laboratory each week. F; 1 unit. Staff.

325. **Bacteriology and Related Microbiology.** Continuation of Microbiology 320. Detailed consideration of viruses, pathogenic fungi, spirochaetes, rickettsia, and other microbial agents of disease; serological methods and routine hospital laboratory procedures applicable to diagnosis of communicable diseases. Two lectures and four hours laboratory each week. W; ⅔ unit. Prerequisite: Microbiology 320 or general bacteriology. Staff.

350. **Advanced Medical Bacteriology.** A course designed to further the knowledge of the student in professional medical microbiology. Recent advanced theory and practice of the aspects of medical microbiology too esoteric for inclusion in Microbiology 320 and 325. Diagnostic and research techniques needed by both the scholar in bacteriology and the professional whose duties include organization and supervision of the clinical bacteriology and serology laboratories. S; 1 unit. Prerequisite: Microbiology 320 and 325. Vicher.

360. **Science Orientation.** A course designed to aid the beginning graduate student in making the transition from undergraduate study to graduate study and in understanding the meaning of science. Lectures and discussions on the development of science attitudes, the life of a scientist, the philosophy and logic of science and experimentation, and the use of medical literature. The course is taught by members of several departments and does not stress any particular field. F; ½ unit. Batson, Kempf, Le Beau, Reynolds, Wakerlin.

401. **Cytology and Metabolism of Microorganisms.** Bacterial structure as it is related to function and biochemical activity of the cell; influence of germicides, antibiotics, and other substances on the morphology and metabolism of bacteria; nature of bacterial respirations. Sp; 1 unit. Prerequisite: General bacteriology; biological chemistry. Staff.

402. **Immunology.** A course designed to teach the general principles of serological reactions, preparation of biologicals, production of the immune condition in animals, demonstration of the cellular mechanisms of immunity, the allergic response, blood groups, forensic serological tests, and practical diagnostic methods based on serological and cutaneous reactions. W; 1 unit. Prerequisite: General and medical bacteriology. Markowitz.

403. **Virology.** Lectures and laboratory work on the nature of viruses, their physical, chemical, and biological characteristics; methods for propagating them in the laboratory; technique of isolating viruses; purifying, concentrating, and observing them on the electron microscope; identification by

laboratory procedures; preparation and testing of vaccines. S; 1 unit. Prerequisite: General and medical bacteriology. Kempf.

404. **Medical Mycology.** A general survey of fungi with special reference to the pathogenic groups causing both superficial and deep mycotic infections. Two lectures and six hours laboratory each week. W or Sp; 1 unit. Meyer.

405. **Microbial Genetics and Cytology.** This course presents a broad understanding of the principles of and techniques utilized in microbial genetics and cytology, and correlates the applications of these principles and techniques to such fields of interest as immunology, chemotherapy, industrial applications of microbiology, biochemistry, and others. Alternate years by arrangement. Sp; 1 unit. Scherr.

491. **Seminar and Literature Review.** Presentation of timely subject material and individual research contributions. Each student is required to present suitable subject material. Required of all graduate students. F, W, Sp; ½ unit each quarter. Prerequisite: General bacteriology. Staff.

493. **Research in Bacteriology.** Individual research in the field of bacteriology, including allied subjects usually included under this title such as virology, immunology, mycology, and protozoology. F, W, Sp, S; ½ to 3 units each quarter. Prerequisite: General and pathogenic bacteriology. Staff.

Oral Pathology

Oral Pathology, a division of the Department of Pathology, offers work toward the degree of Master of Science. The program is devised to provide training for teachers and investigators in the field of oral pathology. A student, however, is required to have a knowledge of the entire field of pathology.

In addition to the general requirements of the Graduate College, the applicant must have received his Doctor of Dental Surgery degree. Nonprofessional students are not accepted.

Courses required of all candidates for the Master of Science degree include Pathology 325 (four and one-half units) or its equivalent, at least four units of Oral Pathology 493, and one unit of Oral Pathology 491. Additional courses and seminars are to be determined by the major adviser on an individual basis and should be in the field of basic sciences. A thesis on an original investigative problem is required.

Students completing the requirements for the master's degree in oral pathology may apply for admission for work toward the Doctor of Philosophy degree in the Department of Pathology, and must comply with requirements of that department for the doctorate.

GRADUATE TEACHING FACULTY

Professor: Joseph P. Weinmann.

Assistant Professor: Surindar N. Bhaskar (on leave of absence for military service).

COURSES FOR GRADUATES

491. **Seminar in Oral Pathology.** Weekly reviews, reports, and discussion of topics drawn from the literature and the material of surgical oral pathology. F, W, Sp; ½ unit each quarter.

493. **Research in Oral Pathology.** F, W, Sp, S; ½ to 3 units each quarter.

Oral Surgery

The degree of Master of Science is offered in oral surgery. The program is designed to train teachers and investigators, as well as to provide a basic science background in oral surgery.

A Doctor of Dental Surgery degree from an accredited institution is required for admission. In addition, the applicant must have satisfactorily completed three quarters of an organized postgraduate curriculum leading to a certificate in oral surgery offered at the University of Illinois College of Dentistry. Three units of advanced credit are allowed toward the Master of Science degree in recognition of the work included in this postgraduate curriculum. The minimum 3.5 grade-point requirement of the Graduate College must be met for admission.

Required courses for the Master of Science degree include at least four units of Oral Surgery 493. Three units of advanced credit are allowed for such courses as Pathology 325, Anatomy 301, Histology 302, and others, or their equivalents, already completed in the postgraduate curriculum. An additional two units to complete the requirements for the degree are to be determined by the major adviser and must include one unit of non-research credit. A thesis on an original investigative problem is required.

The student is on a half-time basis in the Graduate College during his entire period of registration and devotes the remainder of his time to teaching and assisting in the department and/or internship or residency training.

GRADUATE TEACHING FACULTY

Associate Professor: Daniel M. Laskin.

COURSES FOR GRADUATES

493. **Research in Oral and Maxillofacial Surgery.** F, W, Sp, S; ½ to 3 units each quarter.

Orthodontics

The degree of Master of Science is offered in orthodontics. The program is primarily one of training for research and teaching in the basic and applied sciences in orthodontics.

All applicants must have the degree of Doctor of Dental Surgery from an accredited dental college, must meet the 3.5 minimum grade-point requirement of the Graduate College, and must be approved by the departmental staff.

A minimum residence of eighteen consecutive months or two academic years is required. During the first nine months all students are classified in the postgraduate division. Those showing scholarly proficiency and research ability are admitted for the next nine months as candidates for the Master of Science degree in the Graduate College and must write an acceptable thesis on an original investigation and pass an oral examination. Students not accepted for the degree program but who successfully complete eighteen months' work without a thesis receive a certificate of proficiency in orthodontics. This professional program is not administered by the Graduate College.

Required courses for the Master of Science degree include Orthodontics 401 and at least four units in Orthodontics 493. Three units of advanced credit toward the graduate degree are allowed for completion of graduate courses pursued in the postgraduate curriculum. These include Anatomy 301 and Histology 302. Additional courses in the basic sciences or other departments may be required by the major adviser. Students must register for a full program of three units each quarter or spend additional time to complete requirements.

GRADUATE TEACHING FACULTY

Professors: ALLAN G. BRODIE (Head of Department), MILTON B. ENGEL.

COURSES FOR GRADUATES

401. **Orthodontics.** An intensive seminar course covering three quarters and including the study of the phylogeny of teeth, jaws, and head, comparative anatomy and physiology of the dental apparatus, applied functional anatomy and physiology of the human masticatory mechanism, growth and development of the head skeleton and of the human dentition, both normal and abnormal, and the etiology of malocclusion and research methods pertaining to the field. F, W, Sp, S; 5 units (1 to 3 units each quarter). Brodie.

493. **Research in Orthodontics.** Special research in fields appropriate to the major subject. F, W, Sp, S; ½ to 3 units each quarter.

Pathology

The Department of Pathology offers graduate work leading to the degrees of Master of Science and Doctor of Philosophy. Graduate work in this area includes the advanced study of mechanisms of pathogenesis of functional and structural expressions of disease. It involves the utilization of the tools and research methods of the bacteriologist, biochemist, biophysicist, pharmacologist, or physiologist. Such training is of value to those planning an academic career of research or teaching in pathology and as a minor field of study to those who are majoring in other biological sciences.

Students who wish to become competent for the practice of anatomic pathology or clinical pathology, or both of these specialties of medicine, should take postgraduate residency training, not graduate work.

To qualify for admission to graduate study in pathology, the applicant must be an outstanding student who has received his bachelor's degree and has completed the basic science courses, including general and special pathology, in a class A medical or dental school. In exceptional cases, students not seeking the Doctor of Medicine or Doctor of Dental Surgery degree are admitted, providing they have completed medical courses in microscopic anatomy, gross anatomy, biochemistry, and physiology, in addition to Pathology 325 or its equivalent.

Graduate students who are majoring in other biological sciences may elect pathology as a minor providing they have completed medical courses in microscopic anatomy, physiology, and biochemistry or their equivalent. Pathology 325 is required.

Required courses for the Master of Science degree include Pathology 325, 491, and at least four units in Pathology 493. Suggested courses in addition are Pathology 402 and 403. Attendance at certain staff conferences, seminars, and clinical pathologic conferences may be required.

Candidates for the degree of Doctor of Philosophy must include the following courses or their equivalent in their program of study: Anatomy 301, 302, Biological Chemistry 301, 302, Physiology 324, 325, 326, Pathology 325, 402, 403, 491, and at least nine units in Pathology 493.

The thesis is based ordinarily on the problem selected for investigation and the usual standards for both Master of Science and Doctor of Philosophy candidates are required. Great latitude is allowed in the choice of problems for investigation. Studies concerning any of the biological phenomena operating in health or in disease are considered suitable provided the problem is of adequate dimension, scope, and importance. Theses based on work other than that entailing experimental methods are not approved for doctoral candidates and only in exceptional instances are such theses approved for master's candidates.

GRADUATE TEACHING FACULTY

Professors: Cecil A. Krakower (Head of Department), Granville A. Bennett, George M. Hass, Samuel A. Levinson, Conrad L. Pirani, Joseph P. Weinmann.

Associate Professors: Hubert R. Catchpole, John B. Fuller, Elizabeth A. McGrew.

COURSES FOR GRADUATES

325. General and Special Pathology Including Clinical Pathology. The basic principles of pathological processes, including tissue injury and repair, inflammation, circulatory disturbances, retrograde processes, and tissue responses to specific infectious agents and neoplasms, are considered in the first part of the course. In the latter part of the course, the disease processes affecting each organ and anatomic system are considered in greater detail. The laboratory exercises are designed to correlate and interpret the gross, microscopic, and functional changes occurring in diseased tissues. Lectures, demonstrations, quiz conferences, and laboratory. Thirteen hours each week. F, W, Sp; 4½ units (1½ units each quarter). Prerequisite: Anatomy, histology, and biological chemistry; at least introductory work in microbiology and physiology. Staff.

401. **Experimental Pathology.** Lecture, seminar, and laboratory course in the essentials of experimental pathology. Limited to six qualified students. F; 1 unit. Prerequisite: Undergraduate courses in pathology and anatomy, including histology. Catchpole.

402. **Histochemistry.** Lecture and laboratory course in methods and results of investigation in histochemistry. Fields covered depend on interests of students and may include work with inorganic substances, carbohydrates, vitamins, hormones, nucleic acids, enzymes, and amino acids. Limited to six students. Sp; 1 unit. Prerequisite: Biological chemistry and histology. Catchpole.

403. **Physiological Basis of Endocrine Pathology.** Lecture and laboratory work in physiological mechanisms underlying abnormal endocrine structure and function. Limited to six qualified students to be selected after an interview. W; 1 unit. Prerequisite: Physiology, biological chemistry, and anatomy. Catchpole.

491. **Pathology Seminar.** Weekly seminar covering selected fields of interest and research in pathology. F, W; ½ unit each quarter. Staff.

493. **Individual Research and Advanced Study in Pathology.** F, W, Sp, S; ½ to 3 units each quarter. Staff.

Pedodontics

The degree of Master of Science is offered in pedodontics. The curriculum is devised to train individuals for teaching and research positions in dental colleges and to contribute toward scientific knowledge.

In addition to the general admission requirements of the Graduate College, applicants must have a Doctor of Dental Surgery degree and must have completed three quarters of the postgraduate curriculum in pedodontics. Approval of the head of the department is required.

Three units of graduate credit are allowed as advanced credit for completing the postgraduate curriculum. At least four additional units must be earned in Pedodontics 493. Additional non-research courses, offered in basic science departments, are required.

A thesis on an original problem is required.

GRADUATE TEACHING FACULTY

Professor: Maury Massler (Head of Department).

COURSES FOR GRADUATES

491. Pedodontics Seminar. An intensive seminar course including all problems related to dentistry for children (physical growth, emotional growth, diet and nutrition, endocrinology, health and disease, clinical management, preventive dentistry, and restorative dentistry). Research methods and an introduction to statistics are presented during the spring quarter. F, W, Sp; ½ to 1 unit each quarter.

493. Research in Pedodontics. F, W, Sp, S; ½ to 3 units each quarter.

Pharmacognosy

A program leading to the degree of Master of Science is offered in pharmacognosy. Of a minimum of nine units required for the degree, at least four units of research credit must be in the major field.

Prerequisites for admission, in addition to the general requirements of the Graduate College, include a degree of Bachelor of Science in pharmacy from an accredited institution. The student must show evidence of undergraduate training adequate to the program projected in the Graduate College. Additional undergraduate courses may be required, without graduate credit, to complete the necessary background. Such courses must be completed before or during the first year of graduate study.

The following courses are required of all students: Pharmacognosy 301, 302, and 491. Candidates must complete not less than one unit from the following group: Pharmacognosy 303, 304, 314.

Supporting courses may be chosen from the following: Biological Chemistry 301, 302, Chemistry (Pharmaceutical) 303, 304, 409, Pharmacology 324, 325, 326, 491, Microbiology 401, 402, 403, 404. Other courses may be elected with the approval of the major adviser.

GRADUATE TEACHING FACULTY

Professor: Ralph F. Voigt (Head of Department).

Associate Professor: Charles A. Reed.

Assistant Professors: Conrad A. Blomquist, Frank Crane.

COURSES FOR GRADUATES

301. Plant Anatomy. A microscopic study of the structure of vascular plants, with particular attention to the development and evaluation of the vascular systems in all parts of the plant. Two lectures and two three-hour laboratory periods each week. W; 1 unit.

302. Plant Physiology. A study of life processes in plants, with particular attention to the cell as the fundamental functional unit. The basic principles of plant metabolism are emphasized in relation to essential elements, energy relationships, and other environmental factors. Three lectures or conferences and two three-hour laboratory periods each week. Sp; 1 unit. Prerequisite: Pharmacognosy 301.

303. **Systematic Pharmacognosy.** A taxonomic study of the flowering plants, with particular emphasis upon those of drug import. Relationship of the principal orders and families, rules of nomenclature, and systems of classification are considered. Laboratory work includes identification of species, together with the collection, identification, and preservation of drug plant specimens. Two lectures and three three-hour laboratory periods each week. F or Sp; 1 unit.

304. **Genetics.** A consideration of the fundamental principles of biological inheritance, and the application of these in the study of plant and animal life. Three lectures and two three-hour laboratory periods each week. F or W; 1 unit.

306. **Pharmacognosy of the Allergens.** An atmospheric survey and study of the wind-borne pollen and fungi spores; the identification and distribution of hay fever plants and the practical application of these studies. Two lectures and one three-hour laboratory period each week. Sp, S; ½ to 1 unit.

314. **Histological Techniques.** A theoretical and practical development of the knowledge and skills essential to the preparation of biological materials for microscopic study. One lecture and two three-hour laboratory periods each week. F or W; ½ unit.

316. **Commercial Pharmacognosy.** A study of the traffic in crude drugs and related products, with a consideration of the basic principles governing the production, distribution, and consumption of these materials. Three lectures or conferences each week. F; ½ unit.

401. **Drug Plant Cultivation.** A consideration of the principles involved in the propagation and care of drug plants, combined with practical applications at the Drug Plant Experiment Station. Attention is given to the principles and practices of harvesting, preparation, storage, and marketing. Two lectures and three three-hour laboratory periods each week. Sp or S; 1 unit.

405. **Quantitative Pharmacognosy.** The use of quantitative methods and a study of their application in the macroscopic and microscopic evaluation of drugs, including the development of new methods. One lecture and two three-hour laboratory periods each week. W; ½ unit.

491. **Pharmacognosy Seminar.** F, W, or Sp; ½ unit each quarter.

493. **Research in Pharmacognosy.** F, W, Sp, S; ½ to 3 units each quarter.

Pharmacology

Pharmacology is one of the basic medical sciences in which graduate study is available only at the Professional Colleges. Pharmacology is the science which deals with the qualitative and quantitative aspects of drugs and other chemical compounds upon the living organism. The program of graduate study takes cognizance of the breadth of pharmacology. Specialization is possible in each of the major subdivisions of modern pharmacology including pharmacodynamics, chemotherapy, toxicology, and therapeutics. Pharmacodynamics is the study of physiological and biochemical events resulting from the action of drugs on cells and organisms. Chemotherapy is the study of the selective toxicity of drugs for microorganisms, parasites, and neoplastic diseases. Toxicology is the study of noxious actions of chemical compounds. Therapeutics is the study of the effects of drugs in combating disease.

Pharmacology is intimately interwoven with other medical sciences. A clear understanding of biochemistry and physiology is necessary for the interpretation of drug action. Rational therapeutics depends upon knowledge of pathogenesis and pathology. There is a similarly close connection between pharmacology and bacteriology, biophysics, anatomy, and other fundamental medical disciplines. Accordingly, the programs in pharmacology leading to the degrees of Master of Science and Doctor of Philosophy require broad training in advanced fields of pharmacology as well as a basic background in other medical sciences.

The curriculum is designed to train candidates for teaching in medical school and for research in universities, industry, and governmental laboratories. Courses of study may be arranged to concentrate in one or more of the following subdivisions of pharmacology: toxicology, pharmacodynamics, chemotherapy, or neuropharmacology. Preference is given to aplicants who have completed a major in biological sciences or chemistry in undergraduate courses, and who show evidence of a sincere desire for a teaching and research career in the medical sciences.

Candidates for the degree of Master of Science are required to complete Pharmacology 324, 325, 326, or their equivalent, at least four units in Pharmacology 493, and four units in non-research courses listed in the catalog of the Graduate College, of which no more than one unit shall be in seminar courses.

Candidates for the degree of Doctor of Philosophy are required to complete Pharmacology 324, 325, 326, or their equivalent, and to earn a minimum of nine units in Pharmacology 493 and nine units in non-research courses listed in the Graduate College catalog. The selection of courses is to be made on advice of the adviser and the head of the department. A suitable course or a proven working knowledge of biometrics is required of all candidates for a doctor's degree. The thesis for the doctorate should be of such merit as to warrant publication in part or in full in a recognized scientific journal.

GRADUATE TEACHING FACULTY

Professors: Klaus R. Unna (Head of Department), Walter J. R. Camp.
Associate Professors: Harris Busch, Theodore R. Sherrod.
Assistant Professors: William R. Martin, Cedric M. Smith.

COURSES FOR GRADUATES

324. **Pharmacology, Toxicology, and Chemotherapy.** Principles of therapy; toxicology of heavy metals and industrial solvents; chemotherapy of neoplasms; drugs affecting hematopoesis; chemotherapy of infectious diseases. Lectures, two hours each week. F; ½ unit. Staff.

325. **Pharmacology, Toxicology, and Chemotherapy.** Autonomic drugs; cardiac drugs; diuretics; anesthetics, general and local; adjuncts to anesthesia; sedatives, hypnotics, and analgesics; drug addiction. Lectures, correlation exercises, and laboratory, six hours each week. W; ⅔ unit. Staff.

326. **Pharmacology, Toxicology, and Chemotherapy.** Drugs affecting the central nervous system; toxicology of the central nervous system depressants; anti-allergic drugs; inhalation therapy; vitamins and nutritional factors; endocrine glands. Lectures, conferences, correlation exercises, demonstration, and laboratory, five hours each week. Sp; ⅔ unit. Staff.

401. **Principles of Pharmacological Methodology.** This course presents discussions of the principles and logic of the scientific method as employed in pharmacological research and a series of demonstrations and discussions of specific pharmacological methods emphasizing their use in studies of drug action, their reliability, variability, and validity as scientific methods. Lectures and demonstrations. W; ½ unit. Prerequisite: Pharmacology 324, 325, and 326, or equivalent. Staff.

402. **Biochemical Mechanisms of Drug Action.** This course includes discussions of the kinetics of enzyme action and the role of drugs as inhibitors and activators of components of multienzyme systems as well as of specific enzymes. Advances in chemotherapy of neoplasia, antibiotics, and chemical mediators are in terms of analogue inhibitors and enzyme-substrate interactions. Vitamins and hormones are discussed as cofactors for reactions and control mechanisms for reaction sequences. Lectures. Sp (alternate years); ½ unit. Prerequisite: Pharmacology 324, 325, and 326, or equivalent. Busch and staff.

403. **Pharmacology of Drugs Altering Skeletal Muscle Function.** This course includes discussions of the anatomy and physiology of skeletal muscle and the nature of the alterations in the function of the neuromuscular system produced by drugs, including natural and synthetic curarizing agents, and curare antagonists. Specific topics include structure-activity relationships on curariform compounds, effects of these drugs in man and their use in anesthesia, and methods used in the investigation of neuromuscular function. Lecture and demonstrations. F (alternate years); ½ unit. Prerequisite: Pharmacology 324, 325, and 326, or equivalent. Smith and staff.

404. Neuropharmacology. This course includes discussions of drug action at various levels of the central nervous system. Topics include the physiology and pathophysiology of the nerve cell membrane, the extra pyramidal system, the reticular activating system, the higher inflows to the autonomic nervous system and the cerebral cortex in relation to drug actions which influence epileptic seizure activity, motor dyskinesias, consciousness, psychosomatic disorders, and psychoneurotic behavior. Lectures and demonstrations. F (alternate years); ½ unit. Prerequisite: Pharmacology 324, 325, and 326, or equivalent. Martin and staff.

405. Advanced Topics in Cardiovascular and Renal Pharmacology. Drug action on the cardiovascular system and kidneys, with special emphasis on the failing heart, cardiac arrhythmias, electrolytes and the heart, and renal hemodynamics as influenced by drugs. Lectures. W (alternate years); ½ unit. Prerequisite: Pharmacology 324, 325, and 326, or equivalent. Sherrod.

406. Rational Application of New Therapeutic Agents. Presentation of pharmacological and toxicological considerations of recently developed drugs and of their rational use in therapeutics. Lectures. W (alternate years); ½ unit. Prerequisite: Pharmacology 324, 325, and 326, or equivalent. Staff.

407. Forensic Toxicology. The role played by toxicology in forensic sciences, with particular emphasis on its relation to legal medicine and its congeners. Lectures. Sp (alternate years); ½ unit. Prerequisite: Pharmacology 324, 325, and 326, or equivalent. Camp.

491. Pharmacological Seminar. Weekly seminar. Presentation of original research in pharmacology, toxicology, and chemotherapy. F, W, Sp; ½ unit each quarter. Staff.

493. Research. Supervised research in pharmacodynamics, neuropharmacology, toxicology, chemotherapy, and cellular pharmacology. F, W, Sp, S; ½ to 3 units each quarter. Staff.

Pharmacy

The degree of Master of Science is offered in the Department of Pharmacy. Prospective students must have completed a bachelor's degree in an accredited college of pharmacy or a degree in some other area and be currently in pursuit of a bachelor's degree in pharmacy. The requirement of the Graduate College of a 3.5 undergraduate scholastic average is enforced.

Required work includes Chemistry 303, 349 (no credit if taken previously in the undergraduate curriculum), Public Health 401, four units in Pharmacy 493, and units in other course offerings in the department. Supporting courses in chemistry, microbiology, pharmacology, and other areas must be taken to fulfill the three-unit formal course requirement.

A thesis on an original investigation is required.

GRADUATE TEACHING FACULTY

Professor: Dwight L. Deardorff.

COURSES FOR GRADUATES

400. Hospital Pharmacy. Study and practice of the administrative and operational aspects of hospital pharmacies. One lecture and nine hours practice each week. F; 1 unit.

402. Manufacturing Pharmacy. Lectures and laboratory work on the unit processes and equipment used in the preparation of pharmaceutical preparations. One lecture and nine hours practice each week. F, W, Sp; 1 unit each quarter for not more than three quarters.

491. Seminar in Pharmacy. F, W, Sp; ½ unit each quarter for not more than two quarters.

493. Research in Pharmacy. F, W, Sp, S; ½ to 3 units each quarter.

Physiology

The graduate program in physiology leads to the Master of Science and Doctor of Philosophy degrees. The curriculum is aimed at the education of candidates for careers in teaching and research primarily in relation to colleges of medicine, dentistry, and pharmacy, and for appointments to positions in governmental and industrial institutions and laboratories. Through the graduate program of the department, present and future medical practitioners may receive educational and research experience which is invaluable to sound medical practice and is usually unavailable in regular undergraduate medical curricula.

Applicants with a bachelor's degree who have fulfilled the general requirements of the Graduate College or who have a Doctor of Medicine or Doctor of Dental Surgery degree or who have completed the first two years of the undergraduate medical or dental curriculum are accepted.

The course requirements for the Master of Science degree are Biological Chemistry 301, 302 (or equivalent), Physiology 324, 325, 326 (or equivalent), Physiology 491, and at least four units of research in Physiology 493. Applicants with a Doctor of Medicine degree and students who have completed two years of the undergraduate medical curriculum have satisfied the course requirements of Biological Chemistry 301, 302, and Physiology 324, 325, and 326 but are required to register for three units of graduate formal course work as determined by the adviser. In individual instances, one or more of the following courses may be required: Public Health 401, Physiology 492, Anatomy 302.

For the Doctor of Philosophy degree, course requirements in addition to those for the master's degree are Anatomy 302, 303, Public Health 401, one unit in Physiology 491, one and one-half units in Physiology 492, and at least nine units in Physiology 493 (in addition to those credited toward the Master of Science degree). The minor requirement of four units may be satisfied in anatomy, biological chemistry, microbiology, pathology, and pharmacology, or occasionally in other departments. Conferences and seminars in other departments may be required by the major adviser in addition to specifically listed courses. A thesis of sufficient merit to warrant publication in whole or in part in a recognized physiological or related journal is required.

GRADUATE TEACHING FACULTY

Professors: George E. Wakerlin (Head of Department), Victor Guillemin, Raymond C. Ingraham, John P. Marbarger, William V. Whitehorn.

Associate Professor: Ruven Greenberg.

Assistant Professors: Norman R. Alpert, Vincent V. Glaviano, Neena B. Schwartz, Frank E. South.

Lecturers: Lathan A. Crandall, Harold E. Himwich.

COURSES FOR GRADUATES

301. **Biophysics.** This course presents physical principles, techniques, and instrumentation applicable to biological and medical research, clinical diagnosis, and therapy. Topics are selected from the following branches of physics: mechanics, sound, heat and thermodynamics, electricity, and electronics. Lectures, conferences, and demonstrations. W; ½ unit. Guillemin.

302. **Biophysics.** Continuation of Physiology 301. Sp; ½ unit. Guillemin.

303. **Physical Instrumentation in Biology, Electronics.** This course presents basic theory of electron tubes and electric circuits and applications of electronic equipment in biological research involving measurement of muscle tension, blood flow and pressure, temperature, electric potentials, etc. Three lecture hours each week. W; ½ unit. Guillemin, Macey.

304. **Physical Instrumentation in Biology, Optics.** This course presents theories of optical phenomena with applications to the various optical instruments used in physiological and biochemical research, including colorimeters, spectrophotometers, fluoro and Raman spectrometers, refractometers, polarimeters, phase contrast microscopes, and others. Three lecture hours each week. Sp; ½ unit. Guillemin, Macey.

324. **Human Physiology.** Physiology of muscle and nerve, blood, circulation, and respiration. Lectures, conferences, demonstrations, and laboratory. F; 1 unit. Staff.

325. **Human Physiology.** Continuation of Physiology 324. Physiology of digestion, liver, metabolism, heat regulation, reproduction, kidney and water balance. Prerequisite: Physiology 324. Staff.

326. **Human Physiology.** Continuation of Physiology 325. Physiology of central nervous system and senses. Lectures, conferences, demonstrations, and laboratory. Sp; 1 unit. Prerequisite: Physiology 325. Staff.

401. **Advanced Physiology of the Endocrines.** Study of the concepts of control of

endocrine secretion; the mechanism of action of the hormones and other special problems in the field of endocrinology. W; ½ unit. Prerequisite: Physiology 324, 325, and 326. Schwartz.

402. **Advanced Cardiovascular Physiology.** A course designed to provide advanced graduate students an opportunity to study and utilize experimental procedures that are basic in cardiovascular research. Emphasis is given to modern methods and instrumentation. Lectures, conferences, demonstrations, and laboratory. F, W, Sp, or S; 1 unit. Prerequisite: Physiology 324, 325, 326, or equivalent, or consent of instructor. Alpert, Ingraham, Whitehorn.

403. **The Environment and the Comparative Physiology of Respiration.** A consideration of the mechanisms involved in internal and external respiration of both vertebrate and invertebrate animals as related to their environments. Special attention is given to the physical and chemical characteristics of the environment and to the means by which animals have adapted to them. F; ½ unit. South.

491. **Physiology Seminar.** F, W, Sp; ¼ unit each quarter. Prerequisite: Credit or registration in Physiology 324, 325, and 326. Staff.

492. **Advanced Topics in Physiology.** This course is designed to meet the needs of students desiring advanced, detailed knowledge of a limited field of physiology. Different fields are selected and announced in advance. Subjects are: blood, heart, circulation, muscle, gastrointestinal tract, kidney, endocrinology, metabolism and nutrition, growth, and neurophysiology. F, W, Sp, or S; ½ unit. Prerequisite: Credit or registration in Physiology 324, 325, and 326. Staff.

493. **Research in Physiology.** F, W, Sp, S; ½ to 3 units each quarter. Prerequisite: Credit or registration in Physiology 324, 325, and 326. Staff.

Physiology (Clinical Science)

Degrees of Master of Science and Doctor of Philosophy in physiology are also offered in the Department of Clinical Science. Requirements are identical with those in the Department of Physiology except that research course requirements may be fulfilled by registration in Clinical Science 493.

GRADUATE TEACHING FACULTY

Professor: Andrew C. Ivy (Head of Department of Clinical Science).

COURSES FOR GRADUATES

493. **Research in Clinical Science.** F, W, Sp, S; ½ to 3 units each quarter. Prerequisite: Physiology 324, 325, 326.

Public Health (Biometrics and Applied Statistics)

Graduate programs are not conducted in this field. Students registered for graduate work in basic sciences and other departments may take advantage of the courses offered in this department.

GRADUATE TEACHING FACULTY

Professors: Howard J. Shaughnessy (Head of Department), Herbert C. Batson.

COURSES FOR GRADUATES

401. Biometrics and Applied Statistics. This course is designed as an introduction to the rational use of simple statistical methods in the planning of experiments and evaluation of results. S; 1 unit. Batson.

491. Biometrics Seminar. Student presentation of selected or assigned topics in biometrics or applied statistics. F or W; ½ unit. Prerequisite: Public Health 401 and/or consent of instructor.

Radiology

The graduate curriculum in radiology leads to the Master of Science degree. Graduate work in the field of radiology is provided for the purpose of stimulating the development of critical investigators and intelligent teachers. Facilities are available for research on monochromatic and high intensity soft radiations, on the betatron in its relationship to applied physics and radiobiology, and in the field of experimental and clinical application of radioactive isotopes.

For majors in the department the Doctor of Medicine or Doctor of Dental Surgery degree is required with the exception that undergraduate students may be accepted on a selective basis if they are pursuing work toward the Doctor of Medicine degree and meet the general admission requirements of the Graduate College. The Master of Science degree is not awarded before completion of requirements for the Doctor of Medicine degree.

Courses required of all candidates are Radiology 401, 402, 403, and additional formal non-research graduate courses to make a total of three units, at least four units in Radiology 493 and at least one seminar in a basic science per quarter for three quarters. Attendance is also required at conferences and seminars.

The thesis must be based on an original investigation.

GRADUATE TEACHING FACULTY

Professor: Roger A. Harvey (Head of Department).

Associate Professor: Walter S. Moos.

COURSES FOR GRADUATES

401. Radiation Physics for Medical Application. Weekly conferences on theory, mathematics, mechanics, production, detection, and protection from radiation sources; discussions on radiobiology; analysis of pertinent clinical and research problems. Intended for advanced graduate students using radiant energy. F; ½ unit. Moos.

402. Radiation Physics for Medical Application. Continuation of Radiology 401. W; ½ unit. Moos.

403. Radiation Physics for Medical Application. Continuation of Radiology 402. Sp; ½ unit. Moos.

410. Radioactive Isotopes. Fundamentals of radioactivity are discussed in terms of simple theory, biological effects, and experimental and clinical uses. Stress is placed upon proper techniques for handling, using, storing, and disposing of these hazardous materials. F, W or Sp; ¾ unit (¼ unit each quarter). Harvey, Moos.

493. Research in Radiology. Research in the physical and biological aspects of radiography and radiotherapy using such instruments as monochromatic radiations, high intensity radiations, radioactive isotopes, and the betatron. F, W, Sp, S; ½ to 3 units each quarter. Staff.

Surgery

Graduate training in surgery leads to the Master of Science and Doctor of Philosophy degrees and is designed primarily to encourage the value of basic science research in surgical problems. The art of surgery which pertains to surgical technique has no place in the program of candidates for the Master of Science degree. The candidate for the degree of Doctor of Philosophy must devote the major portion of his time to research but must also become exposed to the art of surgical technique, though the time so devoted shall not apply toward residence requirements or unit values in the Graduate College. Work in the basic sciences is essential for a well-trained scientific surgeon, but this work alone is not sufficient to qualify a candidate for a Doctor of Philosophy degree in surgery. While he might be able to solve problems in surgical disease utilizing fundamental knowledge of physiology or biological chemistry, he must also be cognizant of potential problems in preoperative and postoperative care and surgical convalescence, which knowledge can not be achieved by a pursuit of basic sciences alone.

A Doctor of Medicine degree is required for admission with the exception that medical students who have completed two years of the medical curriculum may apply for graduate work toward a Master of Science degree if they fulfill the general requirements for admission to the Graduate College. The latter class of candidates are not granted a graduate degree in surgery until they have completed requirements for the Doctor of Medicine degree.

A minor is not required for the master's degree, but the candidate is required to obtain four units in non-research courses, of which requirement not more than one unit shall be in seminar courses. Attendance at surgical pathological conferences, journal club, ward rounds and clinics, and surgical research seminars is required.

An applicant for the Doctor of Philosophy degree must choose a minor in one of the basic sciences, and a graduate faculty member in the basic science department shall be the co-adviser with the candidate's major adviser on his research work and thesis. The candidate is required to obtain nine units in non-research courses, at least four units of which must be in the 400-series courses, and not more than two units in the required 400 series may be earned in seminar courses. The additional five units may be in the 300- or 400-series courses. Courses taken during the master's program may be used to satisfy the above requirements.

GRADUATE TEACHING FACULTY

Professors: Warren H. Cole (Head of Department), Géza de Takats, Charles B. Puestow, Max S. Sadove.

Associate Professors: Carl B. Davis, Jr., Russell D. Herrold, Ormand C. Julian.

COURSES FOR GRADUATES

491. **Surgical Seminar.** Discussion of research problems, review of important literature, presentation of research data, and discussion of recent advances in surgical research. F, W, Sp, S; ½ unit each quarter. Staff.

493. **Research in Surgery.** Investigation of problems in surgery, including laboratory and clinical work. F, W, Sp, S; ½ to 3 units each quarter. Staff.

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